THE

FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

THE IRON AND STEEL TRADES JOURNAL

VOL. 50 — Thursday, February 15, 1934 — No. 913

PUBLISHED WEEKLY

Subscription Terms: 15s. per annum.
Foreign and Colonial: 17s. 6d. per annum.
All Subscriptions are payable in advance.

All Communications to be addressed to the Editor, the Advertisement Manager, or the Publisher of

THE FOUNDRY TRADE JOURNAL,
49, WELLINGTON STREET, LONDON, W.C.2.

Telegraphic Address: "Zacatecas, Rand, London."
Telephone: Temple Bar 3951 (5 lines).

Contents

	PAGE
Forthcoming Events	111
Cast Iron Progress	111
Castings and Wastage	111
Correspondence	112
Notes from I.B.F. Branches	112
Malleable Iron Castings	112
Random Shots	112
Problems in Woodworking Machinery Castings	113
Sheffield Foundrymen's Annual Dinner	116
Foundry Bronzes.—No. II	116
Chromium Additions to Cast Iron for Foundry Purposes	117
Sand Control	118
I.B.F.: Lancashire Foundrymen's Annual Dinner	119
Steel Trade Reorganisation	120
Non-Ferrous Foundry Problems	121
Book Review	121
Foundry Selling Practice	122
Import Duties Advisory Committee	122
This Week's News in Brief	124
Trade Talk	124
Contracts Open	124
New Companies	124
Company Report	124
Personal	124
Obituary	124
Raw Material Markets	126

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN, THE NATIONAL IRONFOUNDING EMPLOYERS' FEDERATION, THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES' EQUIPMENT AND SUPPLIES ASSOCIATION

Institute of British Foundrymen

PRESIDENT: 1933-34

C. E. Williams, "Coniston," Cefn-Coed Road, Penylan, Cardiff.

LIST OF SECRETARIES—

General Secretary: T. Makemson, Saint John Street Chambers, Deansgate, Manchester. London Office: 49, Wellington Street, London, W.C.2.
Birmingham, Coventry and West Midlands: L. W. Bolton, 21-23, St. Paul's Square, Birmingham.
Sheffield: T. R. Walker, 33, Ladysmith Avenue, Nether Edge, Sheffield.
Scottish: J. Bell, 60, St. Enoch Square, Glasgow.
Lancashire: J. E. Cooke, 1, Derbyshire Crescent, Stretford, Manchester.
London: H. W. Lockwood, Stewarts and Lloyds, Limited, Winchester House, Old Broad Street, London, E.C.2.
Newcastle-upon-Tyne: J. W. Eckford, 4, Mosley Street, Newcastle-upon-Tyne.
East Midlands: H. Bunting, 82, Otter Street, Derby.
West Riding of Yorkshire: S. W. Wise, 110, Pullan Avenue, Eccleshill, Bradford.
Wales and Monmouth: J. J. McClelland, "Clydesdale," Dover Street, Bilston, Staffs.
Middlesbrough: F. A. Harper, Station Chambers, Middlesbrough.

National Ironfounding Employers' Federation

President: J. Smith, Smith & Company (South Shields), Limited, Nile Street, South Shields.
Secretary: Harold G. Judd, C.B.E., 8, Frederick's Place, E.C.2.

Foundry Trades' Equipment and Supplies Association

President: R. H. Brackenbury, 13, Victoria Street, London, S.W.1.
Secretary: K. W. Bridges, Grand Buildings, Trafalgar Square, London, W.C.2.

Welsh Engineers' and Founders' Association

President: W. E. Clement Morla Foundry, New Dock, Llanelly.
Secretary: E. J. Griffiths, 2, Royal Metal Exchange, Swansea.

BRITISH CAST IRON RESEARCH ASSOCIATION

The Registered Office and Laboratories of the B.C.I.R.A. at:—
21-23, ST. PAUL'S SQUARE, BIRMINGHAM
Telephone: Central 1885. Telegrams: CIRA

The B.C.I.R.A. Scottish Laboratories are:—
Foundry Technical Institute, Meek's Road, Falkirk (*Telephone 332*)

Forthcoming Events

FEBRUARY 28

Institution of Welding Engineers (North-Western Branch):—Meeting at College of Technology, Manchester, at 7.30 p.m. "Recent Advances in the Technique and Application of Electric Welding," Paper by J. H. Paterson.

Institute of British Foundrymen

FEBRUARY 22

Lancashire Branch (Junior Section):—Meeting at Engineers' Club, Manchester. "Foundry Progress during the past Thirty Years," Paper by E. Flower.
Sheffield and District Branch:—Visit to the works of Newton Chambers & Company, Limited.

FEBRUARY 24

East Midlands Branch:—Meeting at the Technical College, Derby, at 6 p.m. Lecture by H. E. Beardshaw.
Newcastle and District Branch:—Meeting at Neville Hall, Newcastle, at 6.15 p.m. "The Work of the Institute's Technical Committee," Paper by A. Logan.
Scottish Branch (Edinburgh Section):—Annual general meeting in the Heriot Watt College, Edinburgh, at 4 p.m. "The Foundry Cupola," Paper by R. S. M. Jeffrey.

MARCH 1

Scottish Branch:—Meeting in the Royal Technical College, Glasgow, at 7.30 p.m. Discussion on Report of Steel Castings Research Committee (Joint Meeting with the Institution of Mechanical Engineers and the West of Scotland Iron and Steel Institute).

MARCH 2

Birmingham, Coventry and West Midlands Branch:—Meeting at the James Watt Memorial Institute, Birmingham, at 7.30 p.m. "The Machining of Cast Iron," Paper by H. Beeny.

MARCH 3

Lancashire Branch:—Meeting at the Engineers' Club, Manchester, at 4 p.m. "Some Aspects of Non-Ferrous Founding," Paper by A. Logan.
Scottish Branch (Falkirk Section):—Meeting at Falkirk Technical School at 6 p.m. "Problems I Have Met." Paper by W. McArthur.

Cast Iron Progress

We have often pointed out that the modern engineering industry originated in the iron-foundry, and that the history of cast iron is in large part the story of its gradual replacement by other materials, particularly the steels. The same is true of wrought iron, and it is felt by many that if the wrought-iron manufacturers had not taken the competition of the products of the Bessemer process as inevitable, they might have been able to hold much more of the market. The same is true of cast iron. As a consequence of thought and investigation it is gradually becoming understood that cast iron is best for many purposes, not because it is the cheapest material, but because it is metallurgically the most suitable. We only need mention, for instance, the adoption of cast iron cam shafts and even crank shafts for some types of motor cars. Of course, the development of the steels did not mean a decline in cast iron production, for the whole market for constructional material expanded at such a rate that the use of all of them expanded, but the rate of increase of output of cast iron was not commensurate with the rate of increase in output of ferrous materials as a whole. The position with respect to cast iron itself is weakened by the fact that many makers manufacture for their own use, and, as large engineering concerns, they are not so much concerned with maintaining the position of cast iron as the jobbing and detached foundries. They are equally prepared to adopt any material which best suits their purposes. This, while in one way a handicap to those who have the interests of the foundry trade most at heart, is perhaps useful in maintaining what may be described as a competitive equilibrium. The same is not true of malleable iron, for the number of engineering firms who make malleable for their own use is a relatively much smaller proportion of the producers as a whole. Yet it would be a bold man who would argue that its competitive position is relatively better, and underlines the point that the difference is not wholly against cast iron. We wish that the industry was sufficiently well organised to collect statistics showing the rise and fall of applications, variations in output and so on, which would enable some concrete idea to be obtained of whether it was or was not holding its own.

Castings and Wastage

In conversation with engineers throughout the last decade we have had impressed upon us the extravagance of foundry processes, inasmuch as they yield an excessive amount of scrap. Yet whenever we visit a scrap dump, we on our part are impressed with the quantities of croppings and flashings, or whatever is the technical term for the discard yielded by the drop-forging process. The essential scrap from foundry processes is relatively unimportant as between its production and re-entry into industrial use it has to carry but a minimum of transport charges. Drop-forging discard made in Birmingham is often used in the furnaces in the Sheffield area.

What the average waste is in the drop-stamping industry we are unable to say, but it is of dual character, that of the ends of the bars, the industry's raw material, and presumably a small piece from each forging made. Because this is "nice clean scrap" it is esteemed by the steel-melting industry, and it will appear as a credit in the books of the drop-forgers; whereas essential scrap, such as runners, risers and grids, is often debited against the foundry. The wastage of primary importance to the foundry industry is the amount of iron lying idle in the form of boxes and tackle, but only an edict has to be issued and this waste is consumed *on the spot*. Sheet-metal work cuttings, too, figure largely in the modern scrap heap, and this constitutes a type of waste which is not esteemed by the steel melter, as it often is surfaced with either zinc or tin or printing inks. If they be bundled or baled, work has to be put upon them. An examination of the question of waste from metallurgical processes has convinced us that the foundry is the most economical of all, because it carries no external transport cost nor serious preparation for reutilisation in industrial processes. It is probably the appearance on the market of cast-iron scrap coming from the demolition of obsolete plant and derelict houses that gives an erroneous impression that foundry work produces an excessive amount of wastage.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

B.I.F. Admission Charge

To the Editor of THE FOUNDRY TRADE JOURNAL

SIR,—As misunderstanding seems to have arisen about the admission charge for buyers visiting the forthcoming British Industries Fair, I should be exceedingly grateful if you would permit me to explain the position.

It is not the fact that buyers will require to pay 2s. upon each occasion they visit the Fair. The arrangement is, that, upon making one payment of 2s., buyers will receive a badge entitling them to attend as frequently as they wish during the entire period of the Fair, *i.e.*, from February 19 to March 2. The one badge will give admission equally to the London and Birmingham Sections without further payment of any kind.

I think it will be agreed that the charge is moderate. Certainly it compares favourably with that made for admission to the leading Continental trade fairs.

May I add that members of the general public will be admitted to the Birmingham Section daily upon payment of 2s. On Saturday, February 24, a reduced charge of 1s. will be made for members of works parties.—Yours, etc.,

C. E. GREENER.
Chairman.
B.I.F. Management Committee.

Birmingham,
February 8, 1934.

Notes from I.B.F. Branches

Burnley Section.—The annual Social of the Burnley Section was held at Greenwood's Café, Burnley, on January 13. There was an attendance of over 100, including Mr. and Mrs. Roy Stubbs, Mr. and Mrs. A. Phillips (President of Lancs Branch), Mr. and Mrs. J. E. Cooke (Hon. Sec. of Lancs Branch) and Mr. T. Makemson (General Secretary of the I.B.F.).

Mrs. Southworth and Mr. H. Meadowcroft won the first prizes given in connection with a whist tournament which preceded dancing.

International Association for Testing Materials

At a meeting of the Permanent Committee of the International Association for Testing Materials held in Paris, the principal work related to the preparation for the Congress which, it is expected, will be held in London in September, 1935. The principle is being followed of concentrating attention on a relatively small number of subjects or groups of subjects with a view to allowing opportunity for thorough discussion, in the same way as was done at the Zürich Congress, rather than to accept numerous reports and papers ranging over the whole field of the testing of materials. The metallurgical subjects finally selected were as follow:—(1) Behaviour of metals (mechanical and chemical) as dependent upon temperature, particularly in regard to high temperatures; (2) progress of metallography; (3) light metals and their alloys; (4) welding, and (5) wear and machinability. Dr. F. Körber was elected President of the Committee on Cast Iron.

The British Committee has held a number of meetings and has considered possible means whereby British members of the Association can be kept in closer touch with the work of the International Association. For this purpose the periodical issue of bulletins has been decided upon. It has also been decided to hold, from time to time, informal discussion meetings open to members of the International Association and others interested in the subject of testing materials for the purpose of considering some of the questions which are presenting themselves to the international body and are likely to be discussed at the forthcoming Congress.

Malleable Iron Castings

As H. Springkämper states in the December 8 issue of "Die Giesserei," that in making blackheart and whiteheart malleable iron castings many failures can be avoided if the annealing process be carried out according to the iron-carbon equilibrium diagram. There are three kinds of iron carbide to be decomposed, the quantity present as well as the temperature of formation of each of which affects the operation. The eutectic carbide as part of the eutectic is formed at temperatures between the freezing point and 1,145 deg. C.; the secondary carbide, which is a decomposition product of the primary and secondary mixed crystals, is formed at temperatures between 1,145 and 721 deg. C.; and the eutectoid carbide as part of the pearlite is formed at 721 deg. C. and below. With increasing total carbon content of the casting the quantity of eutectic carbide increases, whereas the quantities of secondary and eutectoid carbide decrease. Due to the small amounts in which they are present manganese, phosphorus and sulphur do not affect the annealing process. Silicon which is present in somewhat larger quantities, promotes graphitisation and decreases the carbon content, which can be retained by the solid iron at a definite temperature.

To start the graphitisation in a blackheart iron the annealing temperature is preferably chosen the higher the total carbon content is. This high temperature, however, must not be maintained during the entire annealing period, because the higher the temperature is, the larger is the quantity of combined carbon which can be retained in the iron under equilibrium conditions. Further, the higher the temperature the larger will be the grain size. Once graphitisation has started it is, therefore, necessary to lower the temperature to cause further temper carbon to be rejected and further graphite nuclei to be formed, thus obtaining small, evenly distributed temper carbon nodules, together with a fine grain. The iron is kept at the lower temperature until equilibrium conditions are reached, and then slowly cooled. To obtain all the carbon in the form of temper carbon slow cooling must be continued until room temperature is reached. It was found that with an iron containing 0.85 per cent. of silicon, the quantity of combined carbon under equilibrium conditions is, below the pearlite point, as follows:—at 750 deg. C. 0.59, at 500 deg. C. 0.33, and at 200 deg. C. 0.22 per cent. Quenching or rapidly cooling the iron from temperatures at or near the pearlite point will, therefore, produce a hardening structure. This effect is the more pronounced the lower the total carbon content is.

In making whiteheart malleable iron castings some further point must be considered. In a case when the carbon is gasified directly from cementite and not as temper carbon, a brittle coarse-grained casting results. The first annealing at high temperatures must, therefore, be stopped when equilibrium conditions are reached., Further graphitisation and decarburisation is obtained by either a fall in temperature or slow cooling. A further detrimental effect of too high a temperature is the oxidation by carbon dioxide of the iron in the surface layers of the casting when all the carbon has been gasified. Since the carbon monoxide which is formed in this reaction readily decomposes into carbon dioxide and carbon, the oxidation is, in most cases, followed by a cementation, at least in the outer layer of the oxidised zone. Cementation without previous oxidation can also take place whenever the gas mixture is deficient in oxygen. In order to obtain a homogeneous mixture of the new and old iron ore used as packing, heating the castings to annealing temperature must not be carried out too rapidly from 600 deg. C., otherwise an imperfectly annealed casting will be obtained with burnt-on particles of the new ore.

Random Shots

Since I lightly suggested in this column a fortnight ago that ship plates might be abolished in favour of cast-steel hulls for ships, I have been inundated, well, partly submerged, by further and even lighter suggestions *re* hulls, ship, cast-steel. As might be expected, the technical side of the question has interested foundrymen most. A birdie (whom I have usually found most unreliable) has whispered in my ear the news that a rumour is running like wildfire round the clubs (the slate clubs, of course) anent the fact that the new Cunarder is to have a cast-steel hull. If this were true, which, of course, it is not, what a chance there would be for foundrymen! Theoretical men would theorise, practical men would practice, and the foundry equipment people would book orders for 2-ton chaplets.

* * *

In the first place, if the clerk of the weather could not guarantee an absolute rainless summer, so that the casting could be done out of doors, a special shop, about twice the size of St. Paul's Cathedral, would have to be erected, preferably near Steel, Peech & Tozers, where they have one of the biggest batteries of open-hearth furnaces in the country. After collecting enough loam to sink the Mediterranean Fleet, an incredible quantity of moulders would have to be hired. One of Stewarts and Lloyds' excavators would be needed to prepare the bed and release the mould for casting strains. Then would come the question of getting sufficient metal for the pouring; I do not quite know how that would be arranged, but a little thing like that would be no obstacle to the British foundry industry. The cooling, of course, would take some time. As it takes three weeks to cool a hundred-ton-ingot mould, it would perhaps take twelve months to cool the hull of a Cunarder. And when the job was finally done, I wonder, would the Admiralty allow any welding?

* * *

A few days ago "Marksman" discovered the Three-and-Threepenny Wonder Watch. Its owner, a 'bus conductor, accidentally dropped it on to the floor of his 'bus. A large fat man seated by the doorway said: "That's done for it, matey." But, no, the fall hadn't "done for it." The conductor picked up the watch, applied it to his ear casually, knocked it against a seat once or twice, and repocketed it. "No, it's still going. Nothing will stop this watch," he said. "I've dropped it on a cement floor before now and it still keeps good time. I only paid three-and-threepence for it down Petticoat Lane."

* * *

"Marksman" took out his own watch—a presentation gold half-hunter. It was fully wound, yet it was not going. Presentation watches are like that.

* * *

A study of the metallurgy of the alloys used in the horological trade is to be undertaken by the Battelle Memorial Institute, of Columbus, Ohio. "Marksman" suggests that they acquire the 'bus conductor's Three-and-Threepenny Wonder Watch as a starting point for their investigations. But "Marksman" wouldn't part with it at any price if he were the 'bus conductor. Such watches are invaluable!

MARKSMAN.

Problems in Woodworking Machinery Castings*

By Robert Ballantine

Castings used in the construction of woodworking machinery are extremely varied in design, consequently problems continually crop up, and these problems are mostly solved in the hard school of actual practice. The finished machines are classed as machine tools, but one cannot associate the castings used in construction with the massive and weighty units required for metal-working plant. To classify this work is difficult. It neither comes within the light-castings heading nor the heavy-castings section, but the fine finish of the former is essential, coupled with the easy-machining qualities of the latter—truly a problem in itself, due to many causes.

Modern machine-shop practice limits the machining allowances to a degree unheard of formerly, and this degree of accuracy can only be attained by intensive study, right from design to the machined castings. The tendency in woodworking machinery design is for *box sections* in place of *H sections*, large rounds in place of sharp corners, and a blending of perfectly flat surfaces into artistic contours. In comparing designs of castings on old machines with the castings of modern design, one cannot but admit the superiority of the modern product. In comparison with woodworking machines of the eighties the modern design is a work of art. Moreover, from 20 to 30 times the number of castings are now required for the modern machines.

In the majority of castings produced, machined faces are everywhere; metal thicknesses are very irregular and a large area of the metal is comparatively thin. To be successful, logical reasoning is all important in design, pattern construction, moulding, coring, gating, venting, densening and camber. In the first instance, many foundry problems arise through badly-designed patterns, apart from drawing-office design. The ancient practice of giving a blue-print to an individual patternmaker and allow him to saunter through the job is *dead*.

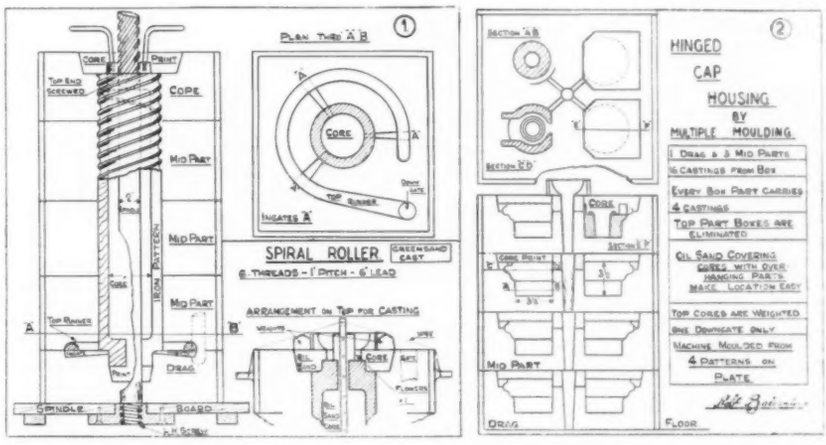
As the management of Messrs. White's is continually evolving new designs and new types of woodworking machinery, a thorough examination of all blue-prints is necessary, before proceeding with the work. Being fortunate (or otherwise) in controlling the pattern shop and foundries, the author is in a position to plan operations right from receipt of blue-prints to the castings. Co-operation with the drawing office is, happily, most harmonious, and any suggestions put forward are generally accepted. The result is, jobs are planned with all the foregoing points taken into consideration.

One of the greatest problems is, how to make the older type of pattern suitable for the economical production of satisfactory castings. Nothing short of scrapping is the only remedy if quantities off are required. Box-section patterns must be substantially constructed for foundry usage, especially where large rounds are shown. Moreover, it has become second nature to the foundry craftsman to make his parting to the flat. The result is that fettling charges soar and castings never have that rounded appearance which is so desirable.

In many cases temporary bars are cast in panels and cut out afterwards. The majority of these box-section castings must be slackened and the core irons broken. True, it is much costlier —but the designer wants *large rounds* and *box sections*. Generally the finished product justifies his desires. Surely, foundrymen are not looking for the line of least resistance? Personal experience is that the cheapest and easiest design for foundry production does not always mean design should be altered to suit their needs.

Over 80 per cent. of our work is done in green-sand moulds, with oil-sand cores, including planing-machine main frames 20 ft. in length. Many of the larger castings are now made two in a box, and a time-study of production costs proves it a much more economical method than working separately. They are poured from the same head box but separate downgates are preferable. Another very important question is that of densening. Mr. E. Longden, of Manchester, once said "We have developed a densening technique which is giving splendid results," and the author agrees with his observations. The saving in rod-feeding time, and the low percentage of rejections due to porosity, more than repays the initial study which is given to this problem.

The insatiable demands of the modern machine shop keeps an attached foundry always on edge. The result is, departure from the recognised and orthodox methods must be made. Four examples of castings have been chosen for study:—The *first* represents an example of unorthodox methods for production; the *second* an example of mass-production castings; the *third* a case where the author objected to design alterations to an existing pattern and looked for the line of least resistance, and *lastly* an older type of pattern made two in a box to cheapen production, and which ought to be redesigned in patternmaking for further economies.



FIGS. 1 AND 2.—MOULDING DETAILS OF A SPIRAL ROLLER AND A HINGED CAP HOUSING.

Spiral Roller

This roller is 30 in. long, 6 in. dia., and has six starts or six definite R.H. threads at an inch pitch. This means that one complete turn of this roller periphery makes a movement of 6 in. As hundreds of these castings are required, the machining was important, every thread being turned from the solid metal. At one period a wooden pattern was made, in halves, with the screws cut in. The results were hopeless, as it was necessary to have a side-screwing movement in drawing the pattern. To make matters worse, the delicate edges were always being broken in the mould. A very visible joint on the casting could not be helped, and finally the original method of casting solid was reverted to.

On going through the machine shop one day and seeing the turning operations, the author suggested that if satisfactory pattern equipment were supplied there was no reason why these should not be cast. Frankly, the administration was a little sceptical.

However, excellent castings were turned out. These castings are produced in green sand with the main centre and the top covering cores in oil sand. A solid iron pattern was turned in the machine shop and made suitable for moulding on-end. The centre 2-in. spindle, as a centre guide, was also supplied, along with a service board. Inserted in the board was a flange, which has a left-handed screw to take the spindle. This makes the spindle perfectly rigid. The top-half of the spindle is screwed and also the top-half of the roller pattern in way of the end-boss. These screws have the same lead and pitch as the roller pattern.

The procedure in moulding is as follows:—The service board is laid on the foundry floor and the centre spindle inserted. When the pattern is lifted by the overhead crane, the plain bore in the bottom of the pattern allows the pattern to slip down over the centre spindle until the threads on both spindle and pattern mesh. The pattern then rotates down to a fixed position from the service board. The drag box is level with the bottom edge of the roller and is rammed up with the ingates in position. A top runner, as shown on the plan (Fig. 1), is placed on the drag, and the mid-parts placed on, one at a time, to allow of uniform fingering and ramming.

When fully rammed, the pattern is screwed out by the handles on top, and lifted away by overhead crane. The complete mid-parts are then lifted off, and the spindle removed through the drag. After the drag is set on a sand bed, the main core is inserted. It will be seen here that the core is enlarged to 2 in. in way of the print, to give a better seating, and also saves altering the spindle hole, which acts as a print. The mid-parts are now lowered into position, and the top covering core ensures true location of the main core. Wire is used for holding down the main core, this passing over the core tube to the box handles. The top covering core provides the two flowers on the top boss.

"Sterling" boxes suitable for multiple moulding are used on this job and are found to be ideal for this work. A specially-prepared facing sand is used with plumbago additions, and a very noticeable feature is the sleeking effect the turned pattern has on the mould when being screwed out. A slight alteration is made in the placing of the ingates since making the drawing (Fig. 1). The three ingates shown on the plan run direct to the centre, but in the castings now being made these ingates are placed at an angle. This is a much better method. With the radial ingates shown on the plan (Fig. 1) the metal has a tendency to churn against the outstanding sand when rising in the mould. The result was, slight washing and fusing took place and coarsened the bottom threads.

* A Paper read before the Edinburgh Section of the Institute of British Foundrymen, Mr. William Wallace presiding.

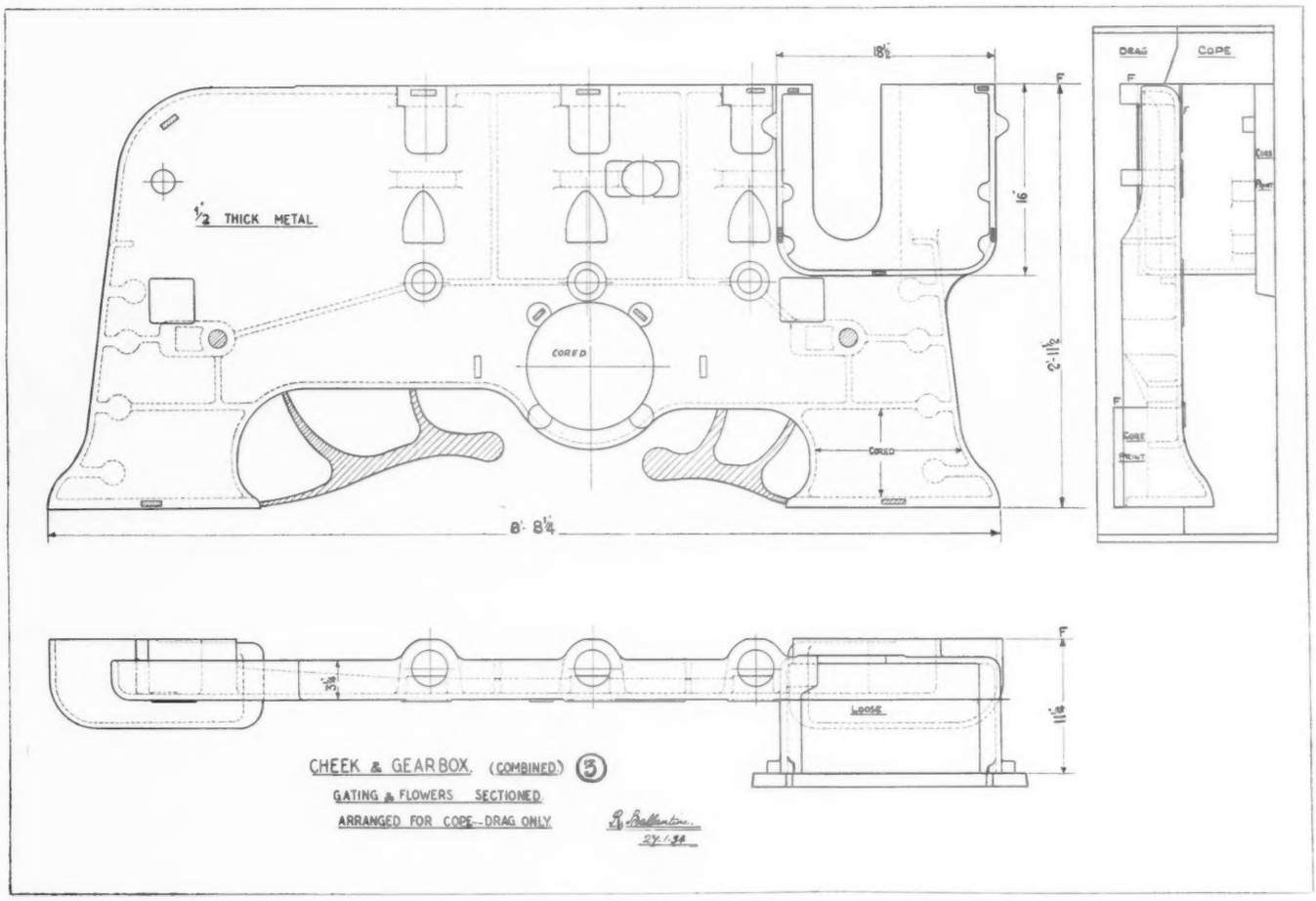


FIG. 3.—MOULDING DETAILS OF A CHEEK AND GEAR COMBINED INTO ONE CASTING.

The angular ingates allow the metal on entering to rotate upwards on the screw thread. This has eliminated very considerably the coarseness at the bottom threads. Conveyor screws are sometimes made by this method, but these are generally single threads, and when one considers that these six separate screws must synchronise perfectly with the guide spindle threads, great credit is due to the engineering department for this fine work. To watch this pattern being screwed out of the sand gives one the feeling that mechanical innovations and unorthodox methods are certainly necessary in progressive foundries.

Hinged Cap Housings

Fig. 2 shows an arrangement for the multiple moulding of hinged cap housings. A tree of castings discloses how top-part boxes are eliminated. As these housings are required in multiples of 48, loose pattern methods were useless. Even four in a box in green sand did not make for satisfactory castings when an alteration was considered. It was found that the neck portion of sand next to the inside facing had a tendency to wash.

A pattern plate, with four patterns was made with provision for coring the inside, an overhanging print being the ideal type. The downgate was tapered with four ingate sprays attached and was pinned separately. It will be seen this method is a plain machine squeeze and pattern draw. Sixteen castings are produced from four one-part boxes of the "Sterling" type. One pouring basin and one downgate serve these 16 castings. The top cores are weighted and boxes clamped.

An examination of the tree will show two features which are outstanding:—(1) The downgate taper makes for a clean fall of metal when pouring and (2) the step made by the covering cores on the ingates acts as a top runner, and these stop any floating impurities from entering the respective moulds. As an experiment, two boxes were skinned in oil sand and dried to compare the finished castings along with those made in green sand. It is still a debatable point in this type of work which is the more satisfactory—green sand or dry sand. Personally the author favours green sand, as it gives a "catchiness" to the skin which is ideal in holding the filling prior to painting and varnishing of the finished machines.

Considerable saving in production times have resulted from this multiple method of moulding, as much as 75 per cent. in some cases. Moreover, floor space is conserved, only one pouring basin is necessary and one downgate for every

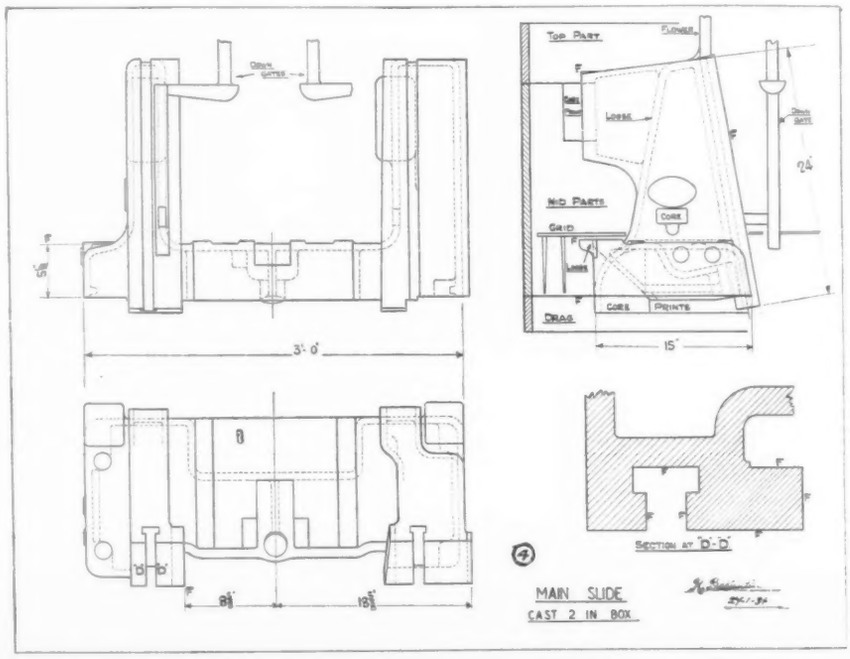


FIG. 4.—MOULDING DETAILS OF A MAIN SLIDE CAST TWO IN A BOX.

16 castings, therefore a bigger return of castings produced for metal melted. Square "Sterling" boxes are used, on the same 12-in. principle as shown in Fig. 2. [An aluminium tree exhibited at the meeting showed 80 castings made in five drags. The castings were 2 in. cube in shape and cored. They were poured from the same head-box, but with two downgates. The top runners were inside the cores and the ingates on the patterns.]

It is all these economies, multiplied by the number of times they occur, that make the difference between profit and loss.

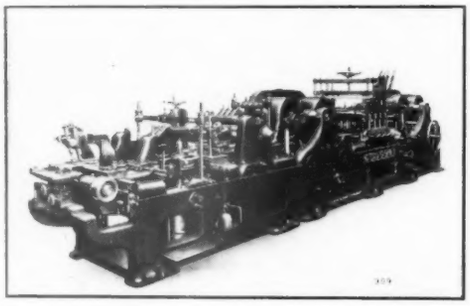


FIG. 5.—A MODERN PLANING, MOULDING AND MATCHING MACHINE.

Combined Cheek and Gearbox

This example has been chosen as an instance where foundrymen sometimes look for the line of least resistance. It shows a combined cheek and gearbox for a triple drum sander, and is approximately 8 ft. 8 in. by 3 ft. by $\frac{1}{2}$ in. metal. As this is an old type of pattern, and has always been made without the gearbox which is seen on the top right-hand side, the author naturally objected to this addition, because it meant that an additional mid-part 9 ft. by 4 ft. by 8 in. had to be rammed up extra every time this was made, and all for the gearbox. His objects were upheld, but in this case one must needs work to the drawing. As twelve were required in this instance, a new top-part box was made. The top-part bars, which were in the way of the gearbox, were left out and a square formed. On the existing pattern the gearbox was pinned, and an overhanging print added.

The pattern is laid on a turn-over board, and the drag rammed up, with ingates in position as is shown by the sectioned lines in Fig. 3. When turned over, and the partings made to ensure nice rounds, the cope box is added. As the top of the overhanging print is level with the top of the cope box, location is perfect when closing. By this method the mid-part has been eliminated. These cheeks are made in green-sand moulds. The gating and position of flowers are shown. These castings have a tendency to swell in thickness if proper care is not taken, but it is found that if the facing sand is rammed fairly hard and the backing sand normally, no swelling takes place. In addition, all this work is well vented by pricker rod. Machining allowances on this job are of the order of $\frac{1}{8}$ in. where marked "F."

Main Slide for a Planing, Moulding and Matching Machine

Fig. 4 shows a main slide for a planing, moulding and matching machine, and is of a type which is machined extensively. There is in this instance a combination of objectionable features. The patterns were old and were not designed for production. Machined faces come within the category of being all over and metal thicknesses are very irregular, and, above all, it is quite a difficult job moulding and closing, although it is made in dry sand. They are cast as they sit, and made two in a box. From the slide it will be seen the cores must be tied down in the drag. A fairly strong grating carries the sand in the mid-parts, and clearances are allowed for easy removal for the re-using of this grating.

In closing the mould, the parting at the top and mid-parts allows accurate setting of the leg core for metal thickness. The Tee slots shown are not cored out but cast solid. From a study of the section through D, D, it is obvious the metal varies very considerably and from $2\frac{1}{2}$ in. to $\frac{1}{2}$ in.

Formerly these were fed by rod, but this has since been stopped and denseners inserted in the mould and core. Nails are placed from the core at an angle to penetrate the slide projection on the right-hand side of Tee slots. A fairly large self-feeding head is placed on top.

Metal for all slides is treated with soda ash, as it gives a much finer sliding face. The porous patches liable to be present at the base of these slots are also eliminated. When the time comes for renewal of these patterns they will be arranged for moulding the opposite way down, and made practically a core-assembly job, with overhanging prints and self-centring locating parts.

A number of photographic slides were shown of finished woodworking machines and the outstanding castings were described.

Fig. 5 shows a modern planing, moulding and matching machine. The main frames are 20 ft. long and made in green sand. When the outside face of the cheek is cast upwards no camber is necessary. These cheeks are extensively ribbed inside and perfectly flat outside, with the exception of the feet, beads, facings and rounds. At one period, these were cast the other way up, *i.e.*, the main plate in the drag. Camber allowances from $\frac{7}{16}$ in. to 1 in. were essential according to length. In explanation the following reasoning is offered—when the plate is cast up the ribs fill first and the plate last; with the result that the ribs are sufficiently rigid to withstand the rise of the plate in cooling, which, of course, fills last. When the methods are reversed, the plate fills first and the ribs last, consequently there is no resistance to the rise of the plate. This means camber is necessary. The foundry is restricted to $\frac{3}{8}$-in. bare machining allowance on this cheek, and these are gated from the bottom side.

A main slide, as shown on Fig. 4, is seen in position. These must be perfectly rigid. The

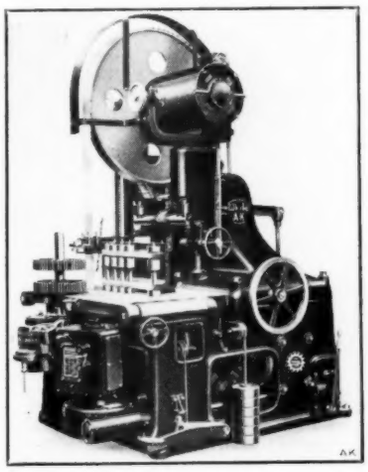


FIG. 7.—A 60-IN. VERTICAL BAND SAW.

top head cutterblock, carrying 10 knives and running at 4,000 revs. per minute on a $7\frac{1}{2}$-in. dia. periphery, must have stability. On this type of machine, feather and grooving flooring can be produced at over 600 ft. per min. Any vibration is disastrous, as it furrows the wood and a series of ripples appear.

Fig. 6 shows a completed triple-drum sanding machine. The cheek casting described in Fig. 3 is seen here, but without the gearbox. The general outline of this machine is very pleasing to look at, and, apart from the utility of this product, very little dust can lie on it, due to the flat surfaces and easy cleaning facilities in design. About 90 per cent. of these castings are moulded in green sand.

Fig. 7 shows a new type of saw, namely, a 60-in. vertical band re-saw, with synchronised motors driving both top and bottom pulleys. The pulleys are 5 ft. in dia., and in this machine every casting was made in green sand. The

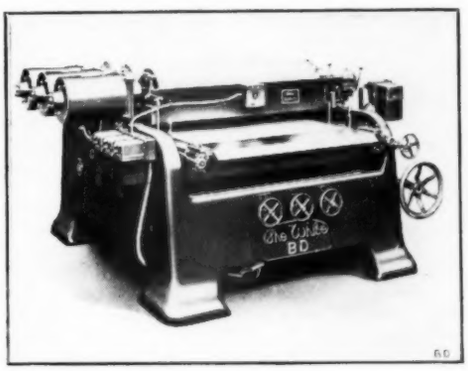


FIG. 6.—A TRIPLE DRUM SANDING MACHINE CONTAINING THE CHEEK CASTING SHOWN IN FIG. 3.

lightening cores seen in the web are no longer necessary. The pulleys are turned all over and dynamically balanced. Despite the perfect turning, the author noticed a series of countersunk holes just under the rim to a depth of $\frac{1}{8}$ in. and four in number at four places. The only conclusion arrived at was that four flowers were taken off the rim and these caused a difference in the density of the metal.

Conclusion

As with all progressive steps taken to eliminate unnecessary labour in a highly-mechanised engineering shop, an attached foundry such as we are, must do likewise to keep pace with that machine shop. The unfortunate position is that evolution is a process in so far as these foundries are concerned.

Unless these foundries are definitely on production jobs, unlimited trouble arises and the best-laid schemes "gang aft agley," due solely to good customers having pet themes of their own, and desiring improvements to be incorporated in standard machines. The result is first-class patterns are butchered and eventually there are more alteration-pieces attached to the pattern than comprises the pattern itself.

Problems in woodworking-machinery castings demand sand control, whilst metallurgical knowledge is essential, but if satisfactory patterns are supplied, half the battle is over in making this type of casting. Departure from the orthodox methods of pattern construction and moulding, especially where quantities off are required, will repay many times over the initial cost. Accuracy, speedier production, less fettling charges and uniform castings follow as a result of giving the moulder the minimum of trouble.

In conclusion, the author desires to record his indebtedness to the directors of Messrs. Thomas White & Sons, Limited, "Headquarters of Woodworking Machinery," Paisley (and incorporating Messrs. John McDowall & Sons, Limited, Sawmill Engineers, Johnstone), for granting him permission to give this Paper.

MESSRS. EDGAR ALLEN & COMPANY, LIMITED, Sheffield, have recently received an order for the supply and erection of a complete gravel plant to be installed in Leicestershire, which will have a capacity of 500 to 600 tons per week.

Sheffield Foundrymen's Annual Dinner

The new competition that foundrymen would have to face by the introduction of fabricated steel was considered by Mr. E. J. Fox (managing director of the Stanton Ironworks Company, Limited) in a speech at the annual dinner of the Sheffield and District Branch of the Institute of British Foundrymen held at the Grand Hotel, Sheffield, on February 2.

Proposing the toast of "The Institute and the Sheffield Branch," MR. FOX said that great credit was due to the Institute for the energetic way in which they were advancing the science of the foundry, particularly in the direction of metallurgical research work that the Institute had tackled so energetically. The interesting Papers that had come before the Society from time to time and the keenness of the discussions indicated that the Institute was certainly one of the most energetic of the scientific institutes. They could not overlook the fact that ironfounding was the very foundation of mechanical engineering, and that being the case, it was essential that their research work should be supported and continued as far as it was within their power to do so. Then, as foundrymen, they had to face the fact that they had a new competitor in the direction of fabricated steel, a material that had introduced a completely new technique in engineering. The extent to which fabricated steel would supplant iron castings depended very largely upon the efforts brought to bear on the part of the foundries to improve their qualities, to reduce their prices and to meet the new competition on all fours. There was no overlooking the presence of fabricated steel as a serious competitor, and for many purposes there was no doubt that it would hold its own. At the same time, it involved a new technique right from the drawing office downwards, which meant that it could probably be adopted less easily by the smaller firms than by the larger establishments. To what extent they were going to meet the new competitor depended upon the skill with which they controlled their own affairs.

Mechanisation of Foundries

The mechanisation of foundries had been much talked of and written about, and there was no doubt that a great deal remained to be done in this country by way of reducing their foundry costs by the adoption of mechanical means. For good reasons they were a long way behind America, Germany, and France in this respect, the chief reason being that in this country they had available a very ready supply of highly-skilled artisans. Such a supply had not been available to anything like the same extent in the three other countries he had named. It followed, therefore, that they had been driven towards adopting mechanical means to a degree that this country, with its supply of skilled artisans, had not found so necessary. However, he thought that the time had now arrived when many British foundries would have to look to their laurels in regard to the extension of mechanisation, and particularly in regard to the mechanisation of the handling of their raw materials.

Foundry Reorganisation Schemes

The BRANCH-PRESIDENT (Mr. W. T. Kitching) replied to the toast. He said that the Institute welcomed the practical man into its ranks. The practical element was the backbone of the Institute. He did not think that such a man would ever be out of a job. He was a gilt-edged asset to the foundry. The foundry director to-day was a harassed man. He was now faced with a national scheme for a reorganisation of adjustment of the foundries, and now he was having to run up to London to listen to advice as to how a national scheme might be formed.

Speaking of mass production in the foundry, the speaker said that it might be a good thing, but he believed that the name of quality, service and standing by the job when it was done was of more value than some mass methods of production. He thought there had been too much bowing and scraping to their foreign competitors. There should be more dictation as to what they intended to do to show that they were not going to reduce their standard of life. They should make it abundantly clear that they did not intend to live in mud huts and eat rice, whatever some of their competitors might do. He expressed his appreciation of the work of the Branch-Secretary (Mr. T. R. Walker).

MR. C. E. WILLIAMS (President of the Institute of British Foundrymen) offered the toast of "The City and Commerce of Sheffield." He paid a warm tribute to the work of Prof. Andrew, Dean of the Faculty of Metallurgy at the University of Sheffield, and remarked upon the setting up by the Institute of a Committee in regard to Prof. Andrew's scheme for the establishment of a degree in foundry technology. The Institute desired to express its appreciation of this effort by the University and Prof. Andrew to raise the status and the art of the foundryman and wished it every success. He wanted to congratulate the Sheffield Branch on the work it was doing and upon the lectures that Dr. Skerl was giving. He was especially glad to note that any foundryman out of employment could attend the lectures without payment. The Sheffield Branch was fortunate in having as its Senior Vice-President Mr. J. E. Hurst, an outstanding man in the foundry industry.

The LORD MAYOR OF SHEFFIELD (Alderman Fred Marshall) and the MASTER CUTLER (Mr. C. J. Walsh) both responded to the toast. They congratulated the Institute upon its work.

The MASTER CUTLER said he believed that the upward trend of trade and employment would continue, and expressed the hope that the time was not far distant when the whole of the foundries of Sheffield would be fully occupied.

MR. J. E. HURST proposed the toast of "The Guests," and said that the proposals of the university to establish a foundry degree course within its Faculty of Metallurgy offered to foundrymen the possibility of a status ranking with the highest professions in the land. The Sheffield University proposals had the wholehearted support of organised foundrymen.

DR. A. W. PICKARD-CAMBRIDGE (Vice-Chancellor of the University of Sheffield) responded, and, alluding to the proposed University course, said there would be, he hoped, honours, degrees, pass degrees and associateships for those who had not actually matriculated. The nature of the course would be scientific, but without neglect of the practical work.

Manganese in South Africa

According to Report No. 565 "Economic Conditions in the Union of South Africa, September, 1933," by MR. N. ELMSLIE, H.M. Senior Trade Commissioner in the Union of South Africa, just published by the Department of Overseas Trade, the short history of the development of the rich manganese deposits at Postmasburg, in the Cape Province, has been very unfortunate. Production commenced in 1929 with 10,306 short tons, and in 1930 it grew to 162,394 tons, and export commenced on a large scale in the middle of the year, after completion of the railway line to the point of production. The fall in demand and price commenced even before full-scale production had been reached and before the end of 1931 production had become uneconomic and was suspended, the output for the year being 112,325 tons. Work has not yet been resumed, although a small shipment of 3,435 tons was made during 1932. The possibility of developing a trade with Canada is being explored and some small shipments were made during the first half of 1933, but it is too early to estimate the possibilities. The production of ferro-manganese is also being considered and experiments are being made. The immediate future of the industry remains uncertain.

Foundry Bronzes.—No. II

LEAD BRONZES

The alloys included in the category of the lead bronzes—so designated to distinguish them from the leaded gun-metals—constitute a series of very useful engineering alloys. These alloys find service in mechanical engineering as bearing metals, and also, in a number of instances, in chemical engineering as acid-resisting metals. Table I gives the composition of a representative range of alloys comprised within the category of the "Lead-bronzes."

TABLE I.—*Composition of Lead-Bronzes.*

	Copper. Per cent.	Tin. Per cent.	Lead. Per cent.
Hard bearing alloy ..	80	12	8
80 : 10 : 10 metal	80	10	10
15 per cent. lead bronze ..	77	8	15
30 " " " ..	65	5	30

Melting-Shop Practice

In general, in compounding the lead-bronzes, the same procedure is followed as that employed in compounding gun-metal. No zinc enters into the composition of these alloys, but it is not unusual to make an addition to the molten copper of a small quantity of phosphorus. This element is introduced in the form of 15 per cent. phosphor-copper, the amount added being in the proportion of ½-2 per cent. of the charge weight.

The function of the tin in lead bronzes is primarily to harden the copper, thereby permitting the formation of a fairly hard matrix in which the insoluble lead segregates out, in pools, during the solidification of the alloy. Thus, a heterogeneous alloy is formed in which a soft constituent is embedded in a hard ground mass—a condition considered ideal for a bearing alloy.

Owing to the tendency of the lead to segregate into larger masses than is considered desirable, and thereby not only giving rise to local weaknesses in a casting, but also destroying the uniformity of the distribution of the lead throughout the mass, resource is had to the beneficial effect of certain "physics" to overcome this tendency. In lead bronzes of low lead content, the presence of the tin in such an alloy assists very materially in overcoming such a happening as that mentioned, but in the case of those alloys having a heavy lead content, it is usual to make an "addition." Nickel, plaster of Paris galena (sulphite of lead), arsenic, sulphur, liver of sulphur, etc., are among the "physics" employed. On the whole, an addition of nickel has proved both efficient in its action and cleaner to use than other substances. Nickel-shot is a convenient form in which to add the nickel, and an addition of 1 per cent. of the charge weight should be made to the molten copper immediately before the introduction of the tin. Care must be taken to ensure that the nickel is dissolved, and its introduction should be followed by a gentle stirring of the melt.

Foundry Practice

The practice outlined for gun-metal should be closely observed. Avoid damp sand and hard ramming. Stir well immediately before teeming. A casting temperature of about 1,050 deg. C. may be regarded as a mean normal figure. Knock out castings as soon as set. Examine the cleaned castings for possible lead separation and scrap those showing any such defect.

THE IRONWORKS of the Liuhokou Coal Mining Company, on the Peiping-Hankow Railway, produce over 30,000 tons of pig-iron and foundry products annually, nearly the whole of which is disposed of in Shanghai.

Chromium Additions to Cast Iron for Foundry Purposes

By J. E. Hurst (Vice-President, Institute of British Foundrymen)

The production of alloy cast irons containing chromium has extended rapidly during the last few years. Chromium additions are made to cast iron for the purpose of obtaining heat-resisting, scale-resisting, wear-resisting and corrosion-resisting properties. Percentages of chromium from very small amounts of the order of 0.10 per cent. up to as much as 6.0 per cent. and even higher in certain grades of austenitic cast irons are used.

Availability of Chromium

The element chromium is available for metallurgical processes in the form of a variety of ferro-chromium alloys, chromium-bearing pig-

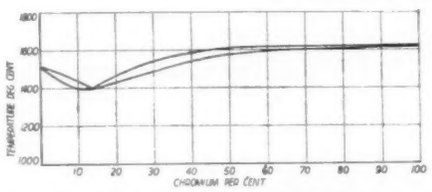


FIG. 1.—MELTING POINTS OF IRON CHROMIUM ALLOYS.

irons and refined chromium pig-irons having guaranteed percentages of this element. The ferro-chromium alloys, apart from their chromium content, are distinguished by the amount of carbon present, and are available from the "carbon-free" varieties, up to those containing as much as 8 to 10 per cent. of carbon. The melting point of the pure chromium itself is high, viz., 1,620 deg. C., as compared with pure iron at 1,528 deg. C. and cast iron of eutectic composition of 1,150 deg. C.

Physical Characteristics

The melting points of the binary iron-chromium alloys is given in the diagram, Fig. 1, illustrating the liquidus and solidus curves of the iron-chromium carbon-free alloys. The lowest melting-point alloy of this series is the one containing 14 per cent. chromium, melting at 1,400 deg. C. The melting point of the alloys richer in chromium increases considerably until with 50 per cent. chromium the melting point is approximately 1,600 deg. C. The melting points of the commercial carbon-free ferro-chromium alloys are approximately in accordance with these figures, and it may be expected that a 50 per cent. alloy will melt at 1,600 deg. C., practically 450 deg. C. higher than eutectic cast iron, and even the lowest melting-point carbon-free alloy melts at a temperature approximating 250 deg. C. higher than that of eutectic cast iron. With the presence of carbon the melting points of the iron-chromium alloys change, but full details of the liquidus and solidus temperatures of the iron-carbon-chromium alloys are not accurately known. An approximate idea may be had from some values obtained by Austin (J.I.S.I., 1923, No. 11) and reproduced in the following table.

TABLE I.—*Liquidus and Solidus Temperature of Some Iron-Carbon-Chromium Alloys.*

Chromium. Per cent.	Liquidus temperature. Deg. C.		Eutectic temperature. Deg. C.
	1 Per cent. carbon.	5 Per cent. carbon.	
15	1,385	1,275	1,180
20	1,425	1,350	1,190
30	1,420	1,390	1,265
40	1,420	1,490	1,280

Whilst the values given in the above table show the likelihood of the melting of high-carbon ferro-chromium commencing to melt at a temperature more near that of cast irons the final melting points are still at values substantially higher. The investigations already made into the chromium-carbon series of binary alloys show the existence of alloys possessing very high melting points. In these alloys containing 6 to 8 per cent. carbon, percentages such as exist in hard ferro-chromium, there exist components which melt completely above temperatures of 1,600 to 1,700 deg. C. and with locally higher carbon contents they melt at still higher temperatures. This circumstance has led to certain abnormalities in the practical manufacture of the harder chromium alloys, and the presence of primary coarse carbide crystals or their unmelted residues cause coarse crystallisation of the carbide portions, heterogeneity and the cracking of castings (*vide* Valenta J.I.S.I., 1930 C.S.M., page 81). These considerations of the high melting point of rich ferro-chromes either of the carbon-free or high-carbon varieties, add very considerably to the difficulties of their satisfactory use in ordinary foundry practice for making chromium additions to cast-iron alloys. In ordinary foundry practice, melting is carried out in the cupola furnace and the only methods available of utilising ferro-chromes for making additions are direct in the cupola, along with the iron charge or to the molten metal in the ladle. The extreme difficulty of ensuring complete mixture and solution of the chromium, even when added in the form of fine powders, will be appreciated from a consideration of the melting points.

Crucible Melting Losses and Difficulties

These difficulties are confined not only to the cupola melting but to crucible- and hearth-type

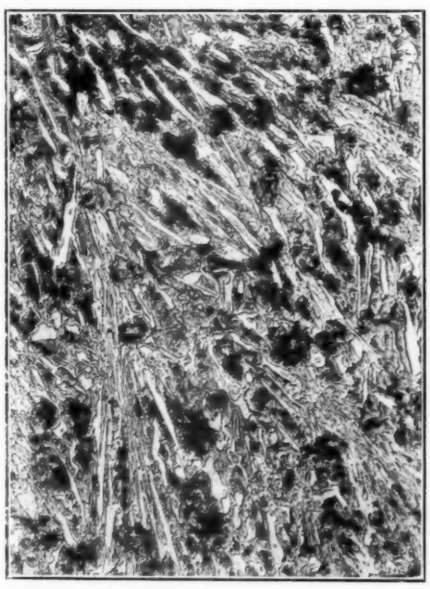


FIG. 3.—ETCHED STRUCTURE OF CHROMIUM PIG-IRON. (38 B.) × 200.

furnace melting. In order to ensure the complete solution and admixture of chromium to iron mixtures, melted in such furnaces, a high temperature, coupled with ample soaking, stirring and rabbling of the charge is necessary. The powerful effect of chromium in the preservation of the free carbides in cast iron, and consequently on the structure and properties of the material, demands careful and exact control of the additions of this element. Small variations are likely to be accompanied by violent changes in hardness and machinability. The careful iron-founder will be influenced also by considerations of cost, and the extra cost of making chromium additions imposes an obligation to take every precaution to ensure regularity and the absence of chromium losses and waste.

In a later study of the ternary iron-carbon-chromium system by von Vegesak (Zeit. Anorg. Chemie, 1926, Vol. CLIV. Special No. p. 30) this investigator discovered the existence of a ternary eutectic containing approximately 8 per cent. chromium, 3.6 per cent. carbon and 88.4 per cent. iron, having a melting point of 1,050 deg. C. The location and composition of this ternary eutectic has suggested the possibility

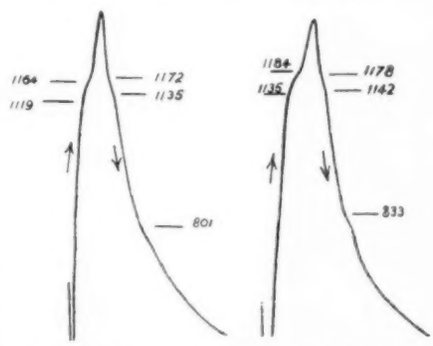


FIG. 2.—HEATING AND COOLING CURVES OF CHROMIUM PIG-IRONS. LEFT 82 B AND RIGHT 38 B.

of using iron-carbon-chromium alloys of this approximate composition for the making of additions of this element to cast iron. Such an alloy with a melting point practically identical with that of ordinary commercial cast irons has obviously every advantage in the making of chromium additions successfully in ordinary foundry practice. An alloy of this type is now manufactured in pig-iron form and is supplied with silicon, manganese and phosphorus contents to suit individual requirements. The effect of the presence of silicon, manganese, together with slight variations in the chromium content, may be expected to alter the properties from that of the ternary eutectic referred to above. An actual study of two specimens of this material is given below. The chemical composition and details of the thermal arrest points are given in Table II.

TABLE II.—*Composition and Melting Points of Chromium Alloy Pig-Iron.*

Specification No.	38 B.	82 B.
Total carbon, per cent. ..	2.95	4.00
Silicon, per cent.	3.05	2.00
Manganese, per cent.	0.81	0.46
Sulphur, per cent.	0.081	0.088
Phosphorus, per cent.	0.061	0.45
Chromium, per cent.	8.06	7.90
Melting, commenced deg. C. ..	1,135	1,119
,, finished deg. C. ..	1,184	1,164
Freezing, commenced deg. C. ..	1,178	1,178
,, finished deg. C. ..	1,142	1,135
Recalescence in solid range, deg. C.	833	809

The actual cooling curves are illustrated in Fig. 2 and the etched microstructures in Figs. 3 and 4. These results show that the melting and freezing of these irons takes place over a short temperature range of approximately 50 deg. C., the maximum temperature in each case being approximately that of the melting point of eutectic cast iron. The microstructures show a large proportion of the material in each case

to be of eutectic character. The following results are taken from the records of experiments of various methods of making chromium additions to cupola-melted cast irons. The cupola plant in which the experiments were carried out was operated in conjunction with a receiver. The mixtures were charged in 5-cwt. units and the receiver contained at least four unit charges before samples of the molten metal were taken for analysis. The experimental mixtures in each case were made up from materials specially analysed and carefully calculated. The experimental results given below are described with reference to the chromium content.

Experiment 1.—Addition of chromium by means of 50 per cent. ferro-chromium added to the cupola mixture.

Total weight of charge, exclusive of addition	560 lbs.
Actual chromium content of ferro-chromium	48.6 per cent.
Chromium content desired in final metal	0.40 to 0.60 per cent.
Weight of ferro-chromium addition to charge	6 lbs.
Calculated percentage of chromium in final metal	0.51 per cent.
Actual percentage of chromium in final metal	0.09 ,,

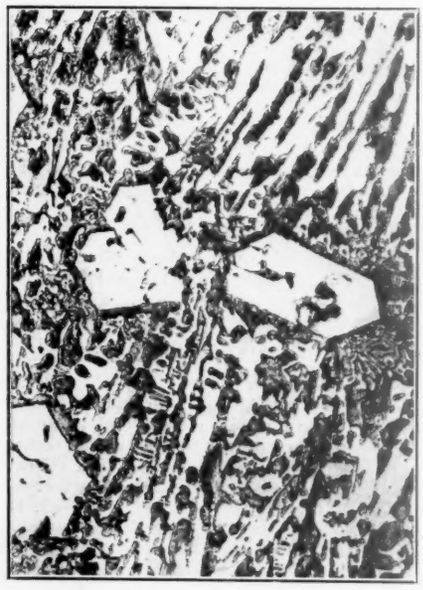


FIG. 4.—ETCHED STRUCTURE OF CHROMIUM PIG-IRON. (82 B.) × 200.

The ferro-chromium was added to the mixture in the form of lumps of approximately large walnut size and thrown in amongst the charge by hand in such a manner as to dispose the alloy throughout the whole charge. The excessive loss noted is equivalent to over 80 per cent. of the ferro-chromium addition.

Experiment 2.—A repetition of the above experiment using slightly smaller ferro-chromium added in the same manner.

Total weight of charge, exclusive of addition	560 lbs.
Actual chromium content of ferro-chromium	49.2 per cent.
Chromium content desired in final metal	0.40 to 0.60 per cent.
Weight of ferro-chromium addition to charge	6 lbs.
Calculated percentage of chromium in final metal	0.52 per cent.
Actual percentage of chromium in final metal	0.15 ,,

An excessive loss still noted equivalent to over 70 per cent. of the ferro-chromium addition.

Experiment 3.—Re-melting of scrap heads, risers and castings of chromium iron.

Actual chromium content determined on 24 separate pieces taken at random from a total of 25 cwts. of scrap metal :—	
Lowest chromium content	0.11 per cent.
Highest chromium content	0.17 ,,
Mean chromium content	0.12 ,,
Actual chromium content of final metal samples	
Lowest chromium content	0.10 ,,
Highest chromium content	0.13 ,,
Mean chromium content	0.114 ,,

Loss in chromium content taken on the mean value is 0.006 per cent. chromium, which is equal to a loss of 5 per cent. of the original mean chromium content of the metal.

Experiment 4.—Addition to chromium, utilising a refined alloy pig-iron, containing 2.75 per cent. to 3 per cent. chromium.

Total weight of charge, including chromium pig-iron	560 lbs.
Actual chromium content of pig-iron	3.28 per cent.
Chromium content desired in final metal	0.40 to 0.60 per cent.
Weight of chromium pig-iron in charge	75 lbs.
Calculated percentage of chromium in final metal	0.44 per cent.
Actual chromium content in final metal	0.386 ,,

Loss in chromium content equal to 12¼ per cent. approximately of the calculated chromium content.

Experiment 5.—Addition of chromium, utilising a refined chromium pig-iron containing 2.75 per cent. to 3 per cent. chromium, and scrap from previous mixture containing approximately 0.25 per cent. to 0.5 per cent. chromium.

Total weight of charge, including chromium pig-iron and scrap	560 lbs.
Actual chromium content of pig-iron	3.28 per cent.
Actual chromium content of scrap ..	0.39 ,,
Chromium content desired in final metal	0.40 to 0.60 per cent.
Weight of scrap in charge	280 lbs.
Weight of chromium pig-iron in charge	40 ,,
Calculated percentage of chromium in final metal	0.43 per cent.
Actual percentage of chromium in final metal	0.41 ,,

Loss in chromium content equal to 4¾ per cent. approximately of calculated chromium content.

Experiment 6.—Addition of chromium, utilising a refined chromium alloy pig-iron containing 8 per cent. chromium.

Total weight of charge, including pig-iron	560 lbs.
Actual chromium content of pig-iron	7.76 per cent.
Chromium content desired in final metal	0.40 to 0.60 per cent.
Weight of chromium pig-iron in charge	35 lbs.
Calculated percentage of chromium in final metal	0.485 per cent.
Actual percentage of chromium in final metal	0.472 per cent.

Loss in chromium content equal to approximately 2½ per cent. of calculated chromium content.

In presenting these results it is fully appreciated that the conditions existing in the particular cupola plant greatly influence their character and magnitude. In other plants and under other conditions the results obtained may vary greatly. These particular results are of comparative value in that they show the variations in yield of chromium in the final metal when additions are made in various forms under the approximately constant general conditions which must exist in the particular plant. The improved yield due to the additions of chromium in a diluted form either in the scrap or as alloy pig-irons is clearly demonstrated.

Sand Control

THE EXPANSION OF MOULDING SANDS ON HEATING

By F. HUDSON

Since my Paper* was written, some experimental tests have been completed, showing the effect of coal dust on the expansion of green sands when heated, and the results obtained are shown in Fig. 10. It will be observed that the sands tested contain from 0 up to about 2½ per cent. of coal dust, which addition gives 20 per cent. reduction in expansion when heated up to 1,000 deg. C. Incidentally this latter mixture is the one successfully applied to prevent "blind" or "dumb" scabs as mentioned in the Paper. Undoubtedly this benefit obtained by the use of coal dust constitutes one of the reasons why coal dust helps to prevent scabbing. It is interesting to note that incidentally the order of expansion of the sand without coal dust is around ¼ in. to the foot, and it no doubt can be readily appreciated why certain castings readily scab or crack if these expansion forces are not relieved.

Sand expansion must be taken into account if a mistake-proof sand is to be evolved, and obviously a theory must be developed giving the reasons why the addition of certain materials to sand helps to reduce expansion. It is not proposed to outline any theory at this stage except

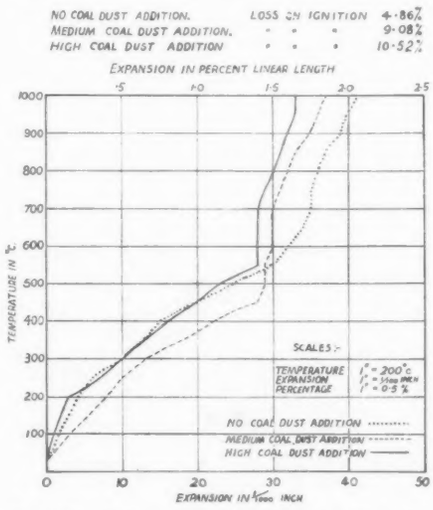


FIG. 10.—EXPANSION OF SANDS WHEN HEATED.

to state that as well as coal-dust additions, it is highly probable that materials such as pitch, resin, etc., will act in the same direction. Furthermore, the minimum expansion will be given by sand that contains:—(1) The highest percentage of old or used sand, and (2) the highest percentage of moisture.

Finally, it is suggested that the importance of expansion is well exemplified in the popularity of oil sand and in the recognised freedom from scabs that this material undoubtedly possesses. Obviously, in good oil-sand practice as soon as the mould is cast this material immediately collapses and relieves any expansion stresses formed at the mould surface. There are other factors which will effect the expansion of any particular sand, but they are too numerous to mention here, but it should be remembered that on top of the sand expansion, one has the normal shrinkage and contraction of the iron, which produces combined stresses of considerable magnitude. In these tests the sand specimens employed were 2 in. long by ½ in. dia. and were rammed in a uniform and comparable manner to conform with practical conditions as far as possible.

* "Commercial Moulding Sand Control for the Modern Ironfounder," by F. Hudson. FOUNDRY TRADE JOURNAL, December 21, 1933, page 351, *et. seq.*

The Institute of British Foundrymen

LANCASHIRE FOUNDRYMEN'S ANNUAL DINNER

The annual dinner of the Lancashire Branch of the Institute of British Foundrymen was held at the Grand Hotel, Manchester, on Saturday evening, February 3. The Branch-President, Mr. A. Phillips, presided, and the dinner was preceded by progressive whist.

Amongst those present were Mr. C. E. Williams, the President of the Institute; Mr. Roy Stubbs (Vice-President) and Mrs. Stubbs; Mr. J. E. Hurst (Vice-President) and Mrs. Hurst; Mr. G. E. Bailey, M.I.Mech.E. (Metropolitan-Vickers) and Mrs. Bailey; Dr. Morley (President of the Manchester Association of Engineers) and Mrs. Morley; and Mr. G. S. Maginness (chairman of the Manchester Engineering Employers' Association) and Mrs. Maginness; Mr. and Mrs. W. Jolley and Mr. V. Delport.

The Annual Dinner of the Lancashire Branch of the Institute of British Foundrymen was Attended by no less than 230 Members and Guests—a Record!

The Toasts

The customary loyal toast was proposed by the Branch-President, and duly honoured.

"The Institute of British Foundrymen"

Mr. G. E. Bailey, M.I.Mech.E., proposing the toast of "The Institute of British Foundrymen," coupled with the name of the President of the Institute, Mr. C. E. Williams, said that the art or craft of moulding could be traced back for thousands of years. In the East it was practised in the temples, in which were to be found specimens in copper, bronze, and even steel. Even in ancient time it was possible to make castings without blow-holes. This early work, however, was carried out with a good deal of ritual. The sun had to be in a certain direction and the moon in a certain quarter; the water used had to be drawn from a sacred river, and the final finishing and closing of the mould had to be done by a specially-elected individual, a High Priest. Above all, the work was carried out in a subdued and dim light, as one would expect in a temple. It might appear to be fantastic to mention ritual in this way, but he, for one, believed that it had taken many centuries of time for that ritual to die out; as a matter of fact, there was still to be observed in a considerable number of foundries that it was necessary to carry on founding operations in a dim and subdued light. Moreover, he had himself seen a foreman hold up the men carrying the molten metal, take a small tin from his pocket, abstract a pinch of something from it, and cast it into the ladle before he waved the men on again.

Competition from Welding

The Institute of British Foundrymen had done a good deal to break down this ritualism, and drive home the fact that if the industry was to succeed in maintaining its legitimate place in the highly competitive markets of the world, it must keep up to date. In addition to having had to face the general slump throughout the world, the industry had had to contend with competition from an unexpected quarter. Owing to the great fall in the price of mild-steel plates, it had been found economical, in many cases, to substitute welded and pressed structures of cast iron. In the lighter section of the industry the introduction of light castings and plastic mouldings from pitch or the "Bakelite" powders had proved to be a serious problem in regard to competition. It was a situation which required serious consideration.

When the Institute held its Conference in June, he hoped to be able to persuade the members to visit a works in which he was interested not only for the purpose of studying foundry methods generally, but especially those of a particular competitor.

The Institute was not only the trustee for the technical interests of the industry, thus ensuring its efficiency at the present day, but also for the purpose of seeing that it should continue to prosper in the future. It was, therefore, gratifying to note that steps were being taken, in conjunction with other bodies, to provide for the adequate training of young men entering the

industry. Particular reference should be made to the degree course which was to be established at Sheffield University. It was hoped that such courses would produce an abundance of young men with technical knowledge.

In conclusion, he wished to express his appreciation of the great services rendered to the Lancashire Branch, and to the Institute generally, by Mr. T. Makemson, the hard-working general secretary, while the good counsel which Mr. Phillips, the Branch-President, had brought to bear in the administration of the Branch was invaluable and would be of lasting benefit to all concerned in regard to questions of management and ownership. Such counsel was necessary, because foundrymen, in common with other industrialists, were apt to think that if a works was operating satisfactorily, and satisfaction was given to customers, that was all that mattered. Regard must be had, however, to the importance of the financial assistance backing up a business organisation. It was gratifying, therefore, to note that a Sub-Committee had been constituted for the purpose of considering costing, because, if the costing system was faulty, then the estimates would be bad, and bad estimates made for unremunerative contracts.

MR. C. E. WILLIAMS, President of the Institute, in responding to the toast, said that, in his opinion, foundrymen ought not to be fearful of the introduction of fabricated steel or of forged steel. At the dinner of the Scottish Branch he referred to the position of the gas industry when, a generation ago, it was faced with the popularity of the incoming electric light. By diligently attending to their own interests the gas industry had succeeded in maintaining a sound financial position, and its shares were now probably as safe an investment as any other good shares on the market. He also desired to stress the importance of research work and of incorporating the results of that work into the practical business activities of the foundry. Those who had read recent numbers of THE FOUNDRY TRADE JOURNAL and studied the articles written by Mr. Hurst, the Junior Vice-President of the Institute, would be satisfied that much progress was being made already in that direction. Dealing with the subjects of high-duty cast iron and alloy cast iron, the writer had stated that a tensile strength of 35 tons was now available in cast iron, which marked a tremendous step forward. The ordinary tensile test for mild steel for shipbuilding in order for it to pass Lloyd's requirements was 28 to 32 tons. Just as the gasworks undertakings, by research work, had been able to produce from their retorts such products as fertilisers, benzol, tar, and a thousand and one others, so could foundries do something similar in another direction. Mr. Hurst had mentioned the use of aluminium, chromium, copper, molybdenum, vanadium and tungsten. Other old friends were such as sulphur and manganese. One Sunday evening he, the speaker, sat down, and by the method of algebraic calculation discovered that 63 combinations were possible with them. By using the elements or substances mentioned by Mr. Hurst, over 8,000 were possible. Having regard to the fact that each element or substance could be mixed in varying proportions, many other combinations must be possible.

Great progress was now being made in the non-ferrous industries, and in his presidential address to the Institute he had referred to the increasing use of aluminium and the extraordinary results obtained by its use.

Plastic metal has been adopted also in patternmaking, and had proved to be of great assistance to the patternmaker, while in the use of sand and of testing materials considerable technical progress had been effected.

Great credit was to be given to the members of Technical Committees and Sub-Committees who not only devoted much of their time and thought to their work, but also in making journeys for the expenses of which they paid themselves, and in publishing the results they obtained not only to the members of the Institute but to the whole world. The Lancashire Branch ought to be particularly proud of this work, because two very prominent members of that Branch had achieved results of conspicuous value. Mr. W. Jolley was the first Convener of Technical Committees and Mr. Glen Primrose had been most assiduous in the assistance he had rendered to the Non-Ferrous Committee.

No one could respond to the toast of "The Institute of British Foundrymen" without wishing, also, to pay a tribute to the memory of the late Mr. Oliver Stubbs, who had given such yeoman service to them all. He was delighted to learn that his Senior Vice-President was his old friend, Mr. Roy Stubbs, and that in June next that gentleman was to be elected President.

The Lancashire Branch

DR. T. B. MORLEY, D.Sc., M.I.Mech.E., President of the Manchester Association of Engineers, proposed the toast of "The Lancashire Branch," coupled with the name of Mr. A. Phillips, the Branch-President.

When the highly-efficient general secretary of the Lancashire Branch, Mr. Tom Makemson, whom he was proud to number among his personal friends, sent him some particulars of the work done by the Institute of British Foundrymen, he was amazed to find that it covered such a wide variety of interests and ranged over such a very wide field of activities. A full tribute of admiration was also due to the hon. secretary of the Branch, Mr. J. E. Cook, for the extremely able manner in which he attended to the domestic affairs of the Branch. The rapid growth of the membership of the Branch was particularly gratifying, and he wished it every success and long-continued prosperity.

MR. A. PHILLIPS, President of the Lancashire Branch, said that the interest and enthusiasm shown at the Branch meetings were a clear indication of the belief of the members of the value of exchanging ideas with respect to foundry problems. Satisfactory castings in ferrous and non-ferrous metals were essential to the Lancashire engineer if he was to maintain his world-wide reputation for good workmanship. He desired to thank the officers and Council of the Branch for the generous support they had accorded to him as President, and also those who had assisted in making the various social functions a success. It would be remiss on his part if he omitted to mention the great amount of work which had been done by the hon. secretary during the past few weeks with a view to making the dinner the success it had proved to be.

He was pleased to see among the guests one of the original members of the Branch, Mr. Wilson, of Liverpool, who joined the Branch when it was formed in 1904. He hoped that that gentleman would be spared to enjoy many more years of good health and prosperity, and that he would be able to attend many more of the annual dinners.

Our Guests

MR. H. SHERBURN, in proposing the toast of "Our Guests," referred to the presence of ladies at the dinner, observing that there was nothing to prevent ladies becoming members of the Institution. As a matter of fact, there were ladies who were members already. He had very great pleasure in coupling with the toast the name of Mr. G. S. Maginness, who was not only closely identified with the Churchill Machine Tool Company, but also added to his troubles by occupying the very important position of chairman of the Manchester and District Engineering Employers' Federation.

MR. G. S. MAGINNESS, responding to the toast, said he had had some experience of foundry practice, inasmuch as 20 years ago he spent a year as an ordinary workman in a brass and nickel shop. He went to work at 5.30 a.m., which was somewhat hard, but was, at any rate, healthy. He had had, also, some connection with foundries, inasmuch as he was the head of a large firm in the Manchester district which bought a considerable number of castings. He would like to pay a tribute to the work of the Institute, because the quality of the products of its members had certainly improved very greatly by the adoption of up-to-date methods in providing the raw materials without which Great Britain would never have enjoyed the high esteem that she now possessed throughout the world for her engineering achievements.

An Invitation by Mr. V. Delport

MR. VINCENT DELPORT, as representing the American Foundrymen's Association, U.S.A., extended a cordial invitation to the members of the Institute of British Foundrymen to attend the Fifth International Foundrymen's Congress to be held in Philadelphia in October of the present year.

Diploma of the Institute

The President of the Institute then presented the Diploma of the Institute to Messrs. H. E. Beardshaw, Mr. E. J. L. Howard and Mr. W. West.

The remainder of the evening was devoted to dancing.

Steel Trade Reorganisation

Mr. Arthur Dorman, speaking at a luncheon of the Tees-side Chamber of Commerce recently, said that the next few months would decide whether the plan for the reorganisation of the iron and steel industry came into proper operation. The plan was so to save competition among manufacturers that they secured an economic price and that they did not, by so doing, kill possibilities of new markets. World trade could not be expected to expand in the same ratio as during last century, and manufacturers realised the necessity for co-operating with each other. Referring to Sir William Firth's advocacy of Government control, Mr. Dorman, while disagreeing, said he thought it was because Sir William felt the scheme would not reduce costs because they had not the power to stop certain works and concentrate production at particular works. He submitted that in any scheme which had as its basis co-operation, a central body, if that central body used its powers wisely, would be regarded not with mistrust, but as a body to be trusted. Ways and means might then be brought about to stop some of the redundant plant, and thereby reduce the cost of production, in this way increasing and not diminishing the export market. Mr. Dorman added that despite the development of iron and steel industries in Africa, Australia and India, the world demand for iron and steel would grow, and Great Britain would have to continue to export a large proportion of its products. Their plan for the steel trade clearly would not be perfect, but it was an effort to work to some plan which, if it was followed properly, should benefit the industry.

Permeability of Refractories

A. E. J. VICKERS in the "Journal of the Society of Glass Technology" shows that the permeability to gas of a refractory cannot be deduced from the porosity, and describes apparatus for measuring the permeability at high pressures, with results of their application to measurements on silica, sillimanite and silicon-carbide refractories.

Iron-Manganese-Carbon Alloys

F. M. WALTERS, JR. and his collaborators have published three further papers on the properties of iron-manganese-carbon alloys in the "Transactions of the American Society for Steel Treating." The first deals with the transformation and non-uniformity of these alloys, and the second with their thermo-electric properties. Manganese reduces the magnetisability of α-iron, and at 16 per cent. Mn non-magnetic ε-Mn is obtained at room temperature. In the third Paper it is shown that manganese considerably raises the electrical resistance of α-iron, but reduces the temperature coefficient. The effect of Mn on γ-iron is very small.

Non-Ferrous Foundry Problems

Mr. F. Dunleavy addressed the East Midlands Branch of the Institute of British Foundrymen at Loughborough College on Saturday, January 27, his subject being "Some Non-Ferrous Foundry Problems." Mr. P. A. Russell presided.

Opening his address, Mr. Dunleavy said that, if it were possible to apply the terms "highbrow" and "lowbrow" to a lecture, his could be definitely termed the latter. He wished to show various types of non-ferrous castings that illustrated some of the many problems with which the non-ferrous founder was faced, and also to draw a line between the small jobbing shop with no modern equipment and where "hand lifting" was the rule, and the larger establishments where lifting tackle, etc., were of ample proportions. This latter point he clearly illustrated in the case of a large drum casting, whereby to facilitate handling in the small foundry the cores were made in sections. The lecturer pointed out that in the large foundry, the core in one piece could be suspended and lowered by mechanical means, but in the small shop this would have to be done by three or four men. This number lifting one core, he contended, would cause unequal lowering with consequent mould and core damage. He therefore made the core in sections that one man could handle and lower into the mould. Mr. Dunleavy mentioned the great amount of knowledge that could be learned from one's waster castings, and, he said, to quote the words of the late Mr. Dews, "The discovery of the cause of the waster was to go three parts of the way to finding the remedy for that waste."

Mr. Dunleavy illustrated by sketches and slides many types of brass, gun-metal and aluminium castings showing defects and methods of their cure.

DISCUSSION

The Branch-President, Mr. P. H. Russell, expressed his appreciation of a thoroughly practical Paper, and was sure that an interesting discussion would follow.

Mr. Hubball, referring to an aluminium ring shown, said he could not appreciate the use of the chills, as the casting was uniform section. He understood chills were used in heavy sections of a casting of unequal sections to facilitate equal cooling. He considered the casting could have been made in a three-part mould with a bottom runner, and chilling would not be necessary. Speaking of the cracking of arms in an aluminium hand-wheel, he had experience of that trouble and overcame it by removing the top box when cast and loosening the sand in the arm spaces to allow the wheel to contract without any binding.

Mr. Dunleavy, in reply, said that to do without the chills in the ring casting would depend on the pouring temperature. He cast at 650 deg. C., so that immediately the mould was filled the metal would begin to "go," and thus prevent the mould gases causing damage. As to the hand-wheels, he made these with a dry-sand core because there were many variations of size and the castings were made from a block pattern, and thus only the corebox required alterations. He used the chill on the boss because the main point was to get the heavy boss to solidify at the same rate as the arms and rim. If the rim was set whilst the boss was fluid, the arms would crack. He did not get one scrap in fifty. The casting must set as quickly as possible, and the chill was necessary.

Gun-metal Liners Cast on Steel

Mr. S. H. Russell said Mr. Dunleavy had solved many of the problems that the non-ferrous founder is called upon to solve. His experience was on larger castings than he (Mr. Russell) was accustomed to handling, but the problems were similar. He agreed with the author that we should always get wasters, but his objection was that it seemed one had to make a waster to find the faults, whereas a little more thought might produce the castings without wasters. Referring to the troubles described by the author when casting a gun-metal liner on to a steel ram, he thought that, if the steel ram was "tinned," 90 per cent. of the troubles would disappear.

The bearings illustrated were somewhat larger than what he had cast, but the principle was similar, and he could not see the necessity of casting such bearings face-down. He thought gun-metal would be as clean on the top as the bottom. Casting with the dome up presented two problems: getting the air away from the cod and loss of pressure because the casting was in the top box instead of the bottom, and pressure was important if not essential. He asked Mr. Dunleavy whether he was satisfied that the heavy down runner would feed a casting. Did not the in-gate freeze first? And, if so, how could the down runner be a feeder?

Mr. Russell agreed with the necessity of chilling heavy gun-metal castings. He instanced a case where a number of castings were made, and after machining one casting it was noticed that the grain was so open that one could see through the casting, and the whole consignment was rejected. The castings were re-made in a permanent mould, and were entirely satisfactory and, incidentally, gave a strength of 17 tons as against the required 11 tons on a small test-bar cut from the casting. For aluminium castings, had Mr. Dunleavy tried gun-metal chills instead of cast iron? He (Mr. Russell) had found these chills quite as effective, and the sweating troubles associated with chills had disappeared. He could not agree with Mr. Dunleavy that overheated aluminium was not spoiled.

Feeding from Down Runners

Mr. Dunleavy said they did not tin the shaft for the gun-metal liners and had not found it necessary. They heated the shaft to a black heat, and if the mould had good provision for the escape of the gases, there would be no trouble. The bearing castings were too big to cast with the face up. If any dross entered the mould, it would be on the machined face and cause a defective casting, but when cast face down, a little dross on the dome portion of a bearing did not necessarily cause a waster. As to the feeding from a runner, he was satisfied it did feed the castings. The hottest metal was in the runner, whereas if one had a riser, the metal in that would be cold after running through the mould. The ingate was made in proportion to the down-runner, and in the case of the large bearings was fully 3 in. deep.

Mr. Russell: Can you keep it up when pouring?

Mr. Dunleavy: Yes, the runner box is choked to keep it up.

Mr. Lucas asked whether the author could explain the action of a chill in gun-metal castings. Did they harden or soften the castings, apart from closing up the grain?

Mr. Dunleavy could not definitely say that chills would harden such castings. They would close the grain. In aluminium castings they would not harden.

Casting Temperatures

Mr. Reeve asked whether he was correct in understanding the author to recommend a pouring temperature of 860 deg. for aluminium, and had the author any experience in "Y" alloy, and what was the most suitable pouring temperature?

Mr. Dunleavy replied that he advocated the pouring temperature of aluminium as 680 deg. C. For "Y" alloys the temperature was the same, but depended upon the ramming density of the mould. A light rammed mould could be cast at a lower temperature than a densely-rammed mould.

Mr. Reeve said his experience was to cast "Y" alloys much hotter, 800 deg. C. at the lowest, as against a minimum temperature of 650 deg. for ordinary aluminium.

Mr. Dunleavy insisted that he never cast any aluminium alloy above 710 deg. C.

Mr. T. Goodwin, proposing a vote of thanks, said it had been very refreshing to hear Mr. Dunleavy confessing his failures. He agreed much could be learned from a study of one's failures, and he was sure everyone present would say that Mr. Dunleavy thoroughly understood his subject. He was sure those interested in the non-ferrous branch of the industry would have gleaned some valuable information.

Mr. E. Stevenson seconded, and said it had been a pleasure to hear a talk given in so pleasing and interesting manner.

Mr. Dunleavy, responding, said what he most enjoyed was a good discussion, and he was very grateful for the reception his Paper had received.

Book Review

Ryland's Directory. Published by the "Iron and Coal Trades Review," 49, Wellington Street, London, W.C.2. Price, cloth bound, £2 2s.; Morocco bound, £2 12s.

Possibly the best way to evaluate the worth of what is in reality Britain's standard directory of the iron, coal, engineering and foundry trades is to imagine that we are back in the foundry again. Reading the morning's mail is usually the first job, and an inquiry is received from a firm unknown to us. Then we refer to the alphabetical list and find that the company has a certain amount of capital, it was registered in 1919, the names of the directors are given and the addresses of its branch works and offices, as well as a note as to the character of the work it undertakes. It may be that the inquiry is sufficiently important to warrant a visit by a representative. If so, then one turns from the alphabetical section to the geographical and examines the locality of the inquirer's works to ascertain whether the traveller can usefully call on his neighbours and so avoid a wastage of time. It can logically be assumed that this firm's competitors may also be interested in our castings, so reference is then made to the "Trades Classified." Here we find a list of our inquirer's competitors and decide whether they are worth approaching by circular letter or not.

Almost before we have finished our mail, there is a complaint to attend to as to the quality and price of certain raw materials. Again reference is made to Ryland's to find alternative sources of supply. Do any of our customers supply this material? Reciprocal trading is always helpful. During the day a few telegrams must be sent, a new trade mark discussed, or the ground planned out for a new traveller. In all cases, reference to Ryland's is the handiest and most complete medium. Towards evening, the designer wants to know whether he can incorporate a certain steel section in his new machine in construction. They are all illustrated and the rolling mills fabricating them are all tabulated. Ryland's is really his only source of reference.

Our enthusiasm for Ryland's dates back to the time when we were in industry, and whenever we changed the location of our position the first thing we bought was Ryland's, and as the years go by we find it still invaluable. Intelligently used, it is helpful to the sales, purchasing and technical departments of any manufacturing or merchant firm. V. C. F.

XUM

Foundry Selling Practice

PRELIMINARY WORK FOR THE SALESMAN

By Eric N. Simons

A matter that impresses the author as more and more important in selling is what might be termed the staff work. A firm may have an excellent set of representatives, but if they are badly handled, as a result of some deficiency in organisation, maximum results will not be obtained from their labours. One aspect of this side of foundry-selling practice is advance work by the sales department for the representatives, or what might be termed preparing the salesman's way. It is in this department that so many foundries seem to be lacking.

What is the customary method of the average foundry, if such a thing as an average foundry exists? There are several representatives who have each a specific territory to cover. These men set forth on Monday mornings, report each evening to headquarters the result of their efforts, and return on Friday evenings, often coming down to the head office on Saturday mornings for a chat with the sales manager and a few friends. It is rare for them to put forward in advance a summary of their itinerary for any following week. It is even rarer for them and the sales manager to get together in an attempt to plan the week's work rationally and to the best advantage.

As a result, their work is hard grind whenever they are not calling on friends and established customers, and the result, only too often, is that the difficult selling problems are shirked, and it is assumed that existing customers and old friends will send in enough work to keep them adequately provided with commission, if continually cultivated. But although this course of procedure may be jolly and satisfactory for all concerned, it cannot by any stretch of imagination be described as scientific selling, and scientific selling is the one thing which these articles are designed to induce. Nevertheless, it is not enough to say that a method is inadequate if no attempt is made to describe what ought to be done. The following notes are an attempt to outline certain ways in which a closer co-operation between sales department and salesmen can definitely increase business or the likelihood of business.

Preparing the Ground

First of all, one main reason why the gaining of a new account means so much expenditure in hard toil and time is the very fact that the new customer either does not know or is but imperfectly acquainted with the castings sold by a particular foundry and their uses. While well-designed advertising and circularising campaigns may do a great deal to remove this unfamiliarity, they cannot do everything. Both advertisements and circulars pass from the memory after a time if not followed up by visits from salesmen, and only in a rare percentage of instances does it happen that the salesman's call coincides with an advertisement or circular unless there has been some careful advance planning.

It is obvious, therefore, that some arrangement whereby the forceful specific advertisement or circular which is likely to have attracted a customer's attention should be followed up almost at once by a personal visit from the salesman must be done. If this can be done, sales will inevitably rise in that particular district. But how is it to be achieved? Here are suggestions.

The salesman should first of all be asked to put forward, a week or so in advance, a detailed account of the towns he means to work, and the approximate dates on which he will be in each. That the salesman should be *asked* and not *ordered* to do this is regarded as essential, because compulsion in such a matter is practically impossible, and even if possible, would do more harm than good. No scheme of co-operation is likely to succeed if the salesman's antagonism has been injudiciously aroused from the start.

The proper method is to indicate the advantages in financial result that the salesman himself will reap from a policy of careful cultivation of territory, getting him used to the notion gradually. It is fairly safe to say that at least one representative will maintain that he cannot sell castings so effectively if he plans his route in advance, and that he needs and demands a completely free hand. These temperamental representatives have to be managed dexterously. The most effective way of bringing them into line is to let them see, as if by accident, the success of the methods in other districts.

As well as providing an advance list of towns to be visited, the representative should also furnish a carefully chosen list of new customers or non-buying customers whom he means to see. It is quite understood that no salesman can give a completely accurate account of the *total* calls he will make. Hence the suggestion of careful choice, only those firms being put down on which the representative definitely engages to call.

Naturally, a visit to an existing purchaser may take up a lot more time than was orginally planned, or long waits may be necessary before an interview can be obtained. Such extensions of time cut across the plan, and upset the programme, if it is too minutely detailed. The great point of the scheme under discussion is the definite engagement by the salesman to make a fixed and not too large number of calls on firms not actually on the order-books. The exact number is left to his judgment. But the point is that the sales manager knows, a week or so in advance, what new firms, *i.e.*, firms not on the books, the representatives in each area are going to visit during a particular period. This knowledge enables him to put up a preliminary "barrage" intended to make the salesman's work easier. This barrage consists of a concentrated advertising campaign, those castings being advertised in the journals covering the industries represented which the purchaser is likely to need; and secondly, of a series of carefully-written, soundly-planned form-letters posted to each of the firms to be visited.

Thus, if the firms to be attacked were shipbuilders and motor-car manufacturers, advertisements would be taken in shipbuilding and motor-car journals for the specific period covered. The form of these advertisements would consist largely of a summary of the advantages of the castings for specific purposes. The form letters would be more personal. They would be worded differently, perhaps, for each firm, according to its activities and position. Thus, in selling castings to a shipbuilder, a different note would have to be struck from that if selling to an automobile manufacturer. The letters should aim to show each firm exactly where the castings could be applied to its own particular needs.

Circular Letters

If the salesman has been able to give the names of the actual buying officials, so that the letters can be individually addressed, this is a great advantage. How often and how many letters are sent depends on how long ahead the visits by the salesman are to be. The vital thing is that every letter should concentrate on facts, excluding all mere generalities. If any specific instances of successful use similar to the requirements of the firm addressed can be given, the letter should contain them. The aim should be to make the buyer familiar with both the name of the firm and the character and advantages of the product before the arrival of the foundry representative. The actual fact that these letters are merely a precursor of the visit should not be mentioned. There is no point in inviting a closed door, nor in giving the buyer an excuse for saying to himself: "Oh, well, if a traveller's coming, he can tell me all I want to know, so this stuff can go in the basket."

Despite the "barrage," the salesman should not anticipate an easy victory, or he may fail as a result of over-confidence. He should proceed in his normal manner, as if unaware that he has been preceded by a campaign. The point of this is that customers sometimes like to make a salesman do his own selling. The literature they have been receiving, the advertisements they may have read, will perhaps have given them a good opinion of the castings, and have raised queries in their minds concerning their applicability to their own requirements. They will put these points to the salesman, and if too readily "pooh-poohed," will lose confidence and interest. Again, buyers often like to compare the claims of a salesman with those made in letters and advertisements. Hence the need for careful preparation of the arguments employed. Extravagant statements differing from the more-restrained claims made by the campaign should be avoided. The representative must, of course, receive copies of the letters sent to his customers.

One great virtue of this scheme is that it definitely ensures the representative's calling on a certain number of new customers. And as the letters do not refer specifically to a visit forthcoming, no trouble is caused should circumstances compel the representative to omit any one visit. The advance bombardment ensures, however, that when he does call, he does not come as a man out of the void, but as the accredited representative of a firm already known.

Import Duties Advisory Committee

ZINC SHEETS: CALCIUM AND SILICON ALLOYS

The Import Duties Advisory Committee give notice of the following applications:—(*a*) For an increase in the import duty on rolled sheets, strips, plates and cut or stamped discs of zinc; (*b*) for the addition to the free list of alloys or mixtures of calcium and silicon or of calcium, silicon and iron, containing not less than 20 per cent. of calcium and not less than 60 per cent. of silicon.

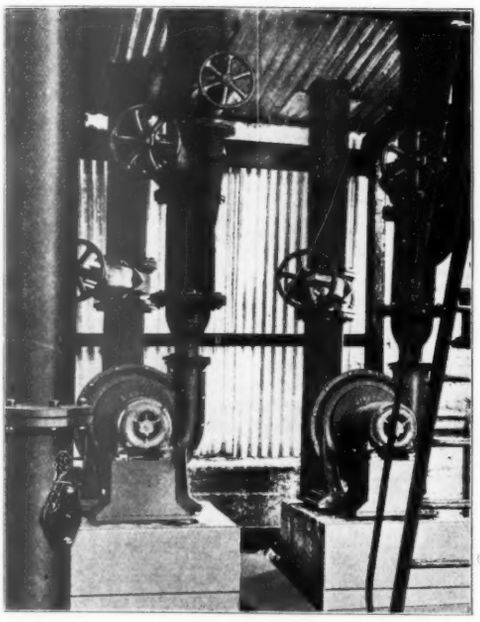
Any representations which interested parties may desire to make in regard to these applications should be addressed in writing to the secretary, Import Duties Advisory Committee, Caxton House (West Block), Tothill Street, Westminster, London, S.W.1, not later than March 5 next.

The Committee announce that the application for drawback under Section 9 of the Finance Act, 1932, in the case of graphite (plumbago) crucibles, and muffle rings, stands, stirrers, and covers therefor, in respect of the natural flake graphite used in their manufacture, has now been withdrawn.

Iron and Chrome Ores in South Africa

According to Report No. 565 "Economic Conditions in the Union of South Africa, September, 1933," by MR. N. ELMSLIE, H.M. Senior Trade Commissioner in the Union of South Africa, just published by the Department of Overseas Trade, the production of iron ores in South Africa has been dependent on the small local demand, and has shown a tendency to fall, the output of 42,186 tons in 1929 and 56,948 tons in 1930 being reduced to 17,027 tons in 1931 and 34,939 tons in 1932. The commencement of production by the South African Iron & Steel Industrial Corporation in 1934 should lead to production on a more considerable scale. Chrome ore is produced mainly for export, and here also the output has decreased heavily, from 70,520 short tons of 42.58 per cent. grade in 1929 to 21,363 tons of 43.21 per cent. grade in 1932.

A NEW TRADE SIROCCO MARK CATALOGUE!



No. S.F. 26 dealing with "Sirocco" Fan Manufactures for moderate and high pressures. It includes some interesting examples of recent installations and contains detailed and accurate information concerning duties, weights and dimensions for the wide range of sizes and designs listed. In addition, numerous tables assist in determining the most suitable "Sirocco" Fan Equipment for use under diverse operating conditions.

A copy for reference is indispensable.

Write to

DAVIDSON & CO., LIMITED,

SIROCCO ENGINEERING WORKS, BELFAST.

LONDON : MANCHESTER : NEWCASTLE : BIRMINGHAM : CARDIFF : BRISTOL : GLASGOW : DUBLIN

.... universally recognised as the leading brand of Cylinder Pig Iron

WARNER CBR

The way to BETTER castings

WARNER & CO. LTD. CARGO FLEET MIDDLESBROUGH

This Week's News in Brief

Trade Talk

A NEW RUMANIAN FACTORY is now under construction by the Marasesti Company, for the manufacture of copper sulphate.

THE No. 8 BLAST FURNACE at Consett, belonging to the Consett Iron Company, Limited, is to be put into operation on February 18.

MESSRS. THE LION FOUNDRY COMPANY, LIMITED, Kirkintilloch, have restored the emergency wage "cuts" made in the salaries of their staff some time ago.

A FURTHER LARGE CONSIGNMENT of steelwork is being loaded by the Russian steamer "Transbalt" at Princes Dock, Glasgow, and is due to sail in a few days.

THE FLYWHEEL and clutch facing of Mr. John Cobb's Napier-Railton car have been made of "Walloy" nickel-chromium cast iron by Walker Steel Works, Limited, Sheffield.

THE MEMBERS of the staff of Messrs. Mitchell Russell & Company, Limited, Chatton Foundry, Bonnybridge, held their annual social meeting last week. The function took the form of a whist drive and dance.

THE ROYAL SCOT TRAIN, now touring Britain, following its visit to Canada and the United States, will be exhibited at the British Industries Fair at Castle Bromwich, Birmingham, from February 19 to March 2.

THE IMPROVEMENT in the heavy industries in the Clyde district is reflected in the brisk demand for scrap and pig-iron and iron ore. Several large cargoes of pig-iron and iron ore have arrived, and others expected immediately.

COPES REGULATORS, LIMITED, Burleigh House, 5-11, Theobalds Road, London, W.C.1, have been appointed the sole distributors in Great Britain and the Dominions for the thermo-electric pyrometers, recorders and heat-control apparatus manufactured by Ether, Limited, Birmingham.

THE DIRECTORS of the Yorkshire Brick Company, Limited, recommend that the capital be increased to £700,000 by the creation of 200,000 additional 6 per cent. cumulative preference shares of £1 each and 600,000 ordinary shares of 5s. each, to rank equally in all respects with the existing shares of each class.

ALUMINIUM WILL BE PRODUCED in Sweden by the A.B. Svenska Aluminiumskompaniet at a new factory at Mansbo in sufficient quantities to meet Swedish requirements. Energy will be derived from the local works of the Swedish Match Company, and the raw material—aluminium-oxide—will be supplied by the Norsk Aluminium Company.

REPORTS FROM WARSAW state that an agreement has been reached between the Polish Ministry of Communications and the Westinghouse Brake & Saxby Signal Company, Limited, of London, for financing the manufacture and installation of brakes and braking equipment for the Polish railways. The contract is for a large sum of money.

MESSRS. ARNOTT YOUNG & COMPANY, LIMITED, Glasgow, have obtained the sanction of the Clyde Navigation Trustees for starting ship-breaking operations in Messrs. W. Beardmore & Company's works at Dalmuir. No time is being lost, and the "City of Chester" is already in the basin for dismantling, after which it will be beached in one of the former shipbuilding berths for demolition.

MESSRS. COLVILLES, LIMITED, state that the Clydebridge works at Cambuslang are now working to full capacity, and likely to remain so for the next three or four months, as a result of the shipbuilding orders placed recently with Clyde yards. The work will be prolonged for a further period in the case of the steel required for naval contracts, as it needs special treatment. Messrs. Colvilles, Limited, during the next four months, will produce between 50,000 and 60,000 tons of steel for naval contracts. Workers who were on part-time employment are now working full time, and a large number of additional men have been engaged.

AN APPLICATION for an all-round increase of 5s. per week for men employed in the tube industry has been refused by Messrs. Stewarts and Lloyds, Limited. The Iron and Steel Trades Confederation, the Transport and General Workers' Union and the National Union of General and Municipal Workers acted on behalf of the men. They claimed that recent trade improvement warranted an increase in wages. It was pointed out by the representatives of the firm at a conference that the increase would have to be refused in the meantime, and stated that when a really large number of men was employed in their works, they would then give consideration to the claim. The parties have arranged to meet again within the next few months.

THE REPORT of the Vereinigte Stahlwerke, A.-G., for the first quarter, October to December, 1933, of the current financial year shows an improved turnover in all departments, except exports, which dropped by £45,000 (at par). The total turnover for the quarter was £8,152,000, as against £7,938,500 in the preceding quarter and £6,940,000 a year previously. Home sales were £5,725,000, as compared with £5,470,000 in the preceding quarter, and foreign sales £2,427,000, as against £2,469,000. Production figures for the October-December and July-September quarters, 1933, and October-December quarter, 1932, were: Coal, 4,103,820, 3,831,790 and 4,076,940 metric tons; coke, 1,125,385, 1,086,010 and 1,078,436 tons; pig-iron, 690,376, 600,237 and 594,860 tons; steel ingots, 853,169, 710,778 and 667,372 tons. Book orders, compared with a year previously, show an increase of 124 per cent.

AN ARRANGEMENT has been entered into between G.W.B. Electric Furnaces, Limited (proprietors, Gibbons Bros., Limited, and Wild-Barfield Electric Furnaces, Limited), and Shell-Mex & B.P., Limited, whereby new high-grade quenching oils will be placed on the market. These oils are being specially manufactured by Shell-Mex & B.P., Limited, in close collaboration with Wild-Barfield Electric Furnaces, Limited, full use of whose extensive experience of hardening-shop requirements has been made. The oils will be known as Shell-Wild-Barfield quenching oils, and will be obtainable from either G.W.B. Electric Furnaces, Limited, London and Dudley, or from any of the branches of Shell-Mex & B.P., Limited. A leaflet has been prepared and can be obtained upon application to G.W.B. Electric Furnaces, Limited, Elecfurn Works, North Road, N.7, or from Shell-Mex & B.P., Limited, General Oils Department, Shell-Mex House, Victoria Embankment, W.C.2.

Contracts Open

Belfast, February 21.—Supply and erection of 2,080 yds. of iron railing, 6 ft. 9 in. high, for the Corporation. The City Surveyor's Department (Engineering Section), Room 94, City Hall, Belfast.

Garlieston, February 20.—Supply and laying of 2,000 yds. of 5-in. cement pressure pipes and 500 yds. of 5-in. cast-iron pipes and specials, for the Wigtown County Council. Mr. A. Merrilees, county sanitary inspector, Douglas House, Newton-Stewart. (Fee £2 2s., returnable.)

Witney, February 22.—Provision and laying of three miles of c.i. water mains, 12 in. dia., and five miles of 3 in. to 8 in. dia., for the Urban District Council. Mr. A. T. Green, engineer, Corn Exchange, Witney (Oxon).

New Companies

Burn & Orson Wright, Limited.—Capital £4,000. Ironfounders, mechanical engineers, etc. Directors: L. B. Burn: O. S. Wright, "Twingates," 36, Southernhay Road, Leicester.

Aga Heat, Limited, 157, Queen Victoria Street, London, E.C.4.—Capital £175,000. To take over the businesses carried on by Bell's Heat Appliances, Limited, and by B.H.A. Productions, Limited. Directors: J. E. V. Jobson, T. G. Bedwell, J. T. Brockhouse, Capt. R. M. Von Heidenstam and W. T. Wren.

Company Report

International Nickel Company of Canada, Limited.—Interim dividend on the common stock of 10 cents.

Personal

MR. GLYN M. JONES has been appointed works manager of the Brymbo Steel (Successors) Company, Limited. Other appointments are:—Mr. Tom Roberts, process manager and metallurgist; Mr. T. G. Littleboy, chief engineer; Mr. J. L. Daniel, assistant engineer. Mr. W. L. Venables is the secretary of the company.

MAJOR H. W. O'BRIEN, managing director of Messrs. O'Brien, Thomas & Company, Limited, ironfounders, of London, has been elected chairman of the Royal Metal Trades Pension and Benevolent Society. He succeeds Mr. Watson Slack. Capt. N. A. Dore, of Messrs. Baldwins, Limited, has been elected vice-chairman of the Society.

Will

WRIGHT, JOHN CLARK, ironfounder, managing director of Burnbank Foundry Company, Limited, Falkirk £6,655

Obituary

MR. NEIL THOM, J.P., who served forty years with the Coltness Iron Company, Limited, and who retired in 1923 from active work, has died at his residence, Sydenham, Newmains, at the age of 85.

DR. FRED IBBOTSON, who died on Monday, February 5, retired last September from the post of Senior Lecturer in the Faculty of Metallurgy at the University of Sheffield. He was a noted author of metallurgical works, and wrote numerous articles on the analysis of metals.

MR. ALFRED LUCAS died recently at his home in Sheffield. For 33 years he was engineer and manager in the Sheffield district for the British Thomson-Houston Company, Limited, retiring from that position a year ago. He was a member of the Midland Institute of Mining Engineers.

MR. JAMES ANDERSON, chairman and managing director of Messrs. Anderson, Brown & Company, Limited, iron merchants, Leith, has died at Edinburgh, at the age of 69. A native of Newport, Fife, Mr. Anderson spent some years with Messrs. Redpath, Brown & Company, Limited, Edinburgh. Twenty-one years ago he founded the firm of Anderson, Brown & Company.

MR. WILLIAM MOIR, of Montrose, who has just died, was a native of Laurencekirk, and had carried on the business of blacksmith for over 40 years. He was for a number of years foreman blacksmith at the Atlas locomotive works, Springburn, Glasgow. Mr. Moir was 77 years of age, and had scientific tastes. He had been a member of the Glasgow Microscopical Society for over 40 years, and was an enthusiastic astronomer.

MR. HUGH MORTON, for many years associated with the ship-repairing departments of Messrs. Barclay, Curle & Company, Limited, has died. He was repair manager at the firm's Clydeside Repair Works, Govan, and in 1912, when the Elderslie Dock was opened, he became general manager at the new works, subsequently being appointed a director. Mr. Morton carried out some valuable work for the Admiralty during the war. He resigned his appointments at Barclay Curle's in 1923, and in recent years he held an appointment in the ship-repairing industry in Southampton.

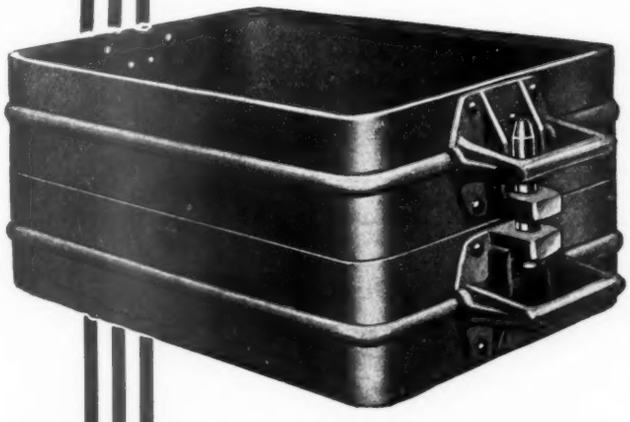
THE DEATH HAS OCCURRED suddenly of Mr. Henneth Moir Sloan, an authority of engineering production, at his residence, Marchfield, Bearsden, near Glasgow. He held the post of London Lecturer on Engineering Production at Glasgow University for about five years. Mr. Sloan saw practical service in various parts of the world, including the South American oilfields. Before starting work on his own behalf as a consulting expert in engineering production and efficiency he was engaged with Messrs. Barr & Stroud, and Messrs. Alex. Stephen & Sons, Limited, Linthouse, Glasgow.

Leipzig Spring Fair, 1934

The Leipzig Engineering and Building Spring Fair is being held on March 4 to 11 next, and will include a representative exhibition of the usual wide range of machinery, machine tools, electrical plant and gear, building materials, pumps, ventilating and heating systems, industrial furnaces, foundry plant, etc. Full particulars regarding the Fair may be obtained from its London office, 34-36, Maddox Street, Hanover Square, W.1.

STERLING MOULDING BOXES

are an essential part of the equipment of every up-to-date foundry



The Sterling Box is more than "just a Moulding Box," it is an accurate tool for producing accurate castings with a minimum of labour and effort

Made from solid ribbed rolled steel

STERLING FOUNDRY SPECIALTIES Limited
LONDON OFFICE:—13 VICTORIA STREET, S.W.1
AGENTS AT MANCHESTER,
GLASGOW & NEWCASTLE-ON-TYNE.
BEDFORD

Raw Material Markets

An increase of 5s. per ton has been made in the prices of most pig-irons. The increase had not been expected for a week or two, but it was generally agreed that it would have to come, in view of the increasing costs of raw materials, coke in particular. Business should proceed on steady lines now that the uncertainty with regard to the future of quotations has been removed.

Pig-Iron

MIDDLESBROUGH.—The rise in the price of Cleveland foundry iron came somewhat as a surprise to the market, as an alteration had not been expected until the end of the month. The increase of 5s. per ton is stated to be the outcome of the sharp upward movement in blast-furnace coke quotations during recent months. The pig-iron producers are fully committed for their immediate output, and cannot accept much more business, especially as there are no unsold stocks of iron remaining. By the end of the month six more furnaces will be in blast in this area than in January, but only one of these will produce ordinary merchant foundry iron. The new minimum quotations for standard No. 3 Cleveland G.M.B. quality are 67s. 6d. per ton delivered to works in the Middlesbrough area, 69s. 6d. per ton delivered to other North-East Coast destinations, 67s. 3d. delivered Falkirk and 70s. 3d. delivered Glasgow.

East Coast hematite has also been increased in price, quotations now being 67s. 6d. per ton f.o.t. makers' works for mixed numbers, and 68s. per ton for No. 1 quality. Three more furnaces will be in blast on hematite in this area before the beginning of March, the major portion of the additional output being required by the local steelworks. Substantial quantities have also been sold to Sheffield, the Midlands and South Wales.

LANCASHIRE.—The consumption of pig-iron in this area generally remains at a good level. Most of the larger users in this area have covered their future requirements of pig-iron for some time ahead, but surprise was expressed at the decision to raise prices. Derbyshire, Staffordshire and North-East Coast brands of No. 3 iron are now on the basis of 72s. per ton, delivered in the Manchester zone, with Northamptonshire at 70s. 6d.

MIDLANDS.—A general revision of prices was made by the Central Pig-Iron Producers' Association last week-end, the first change made for nearly three years. The minimum prices, for delivery in the Black Country, are now as follow:—Northants No. 3, 67s. 6d. per ton; Derbyshire, Lincolnshire and North Staffordshire No. 3, 71s. per ton; the increase also applies to forge qualities. There continues to be a good demand generally. Little Northants iron is left in stock at the makers' works, but fairly large supplies of Derbyshire material are available.

SCOTLAND.—Business in pig-iron is somewhat quieter, as there has been a considerable amount of forward buying lately, before the upward movement in prices. Scottish foundry is now at 70s. for No. 3, f.o.t. furnaces, with 2s. 6d. extra for No. 1. There has been considerable pressure recently for No. 3 Cleveland iron, which is now quoted at 67s. 3d. at Falkirk and 70s. 3d. at Glasgow.

Coke

The foundry-coke market displays a firm tone, as there has been a considerable amount of forward buying by consumers since the beginning of the year. A fair number of spot transactions is still being done, however. Present quotations, delivered in the South Staffordshire area, are as follow:—Best Durham foundry, 36s. 6d. to 40s.; Welsh coke, 35s. to 47s. per ton.

Steel

Quieter conditions have developed in the steel markets, but this is not surprising, as buying has been active for many weeks past. Another reason for the decline in new business is, probably, that the market has not yet settled down to the recent price advances. Business in semi-finished steel also has slowed down, but all the producing works are sufficiently well off for orders to keep them busy for some time. There was some heavy buying of this material in January, and most of the large consumers have covered their forward requirements. In the finished-steel department, certain descriptions of steel which have been allowed a free market have now been brought under control and fixed prices agreed upon; and for a time this has caused some interruption in business. The works, however, have well-filled order-books. Export business is quiet, but shows signs of improving.

Scrap

The scrap-iron markets are generally displaying a firmer tone following the increase in the prices of new pig-iron. In the Cleveland area, ordinary cast-iron scrap is quoted at 53s. 6d. and machinery quality at 55s. per ton. There continues to be a steady demand in the Midlands, where heavy machinery metal is at 55s., good heavy at 50s., and clean light scrap, which is reported to be scarce, at 47s. 6d. per ton, all delivered works. In Scotland, good heavy machinery scrap is firm at 57s. 6d. upwards, ordinary cast iron being quoted at 54s. to 55s.

Metals

Copper.—The erratic tendency shown by copper quotations during the last few days has been largely due to exchange fluctuations, which continue to exercise a considerable influence upon the market. Consumption remains at a fairly satisfactory level, and many of the brass-manufacturing works are quite busy, particularly in Germany. Many of the larger consumers in this country are not well covered as regards their forward requirements, but there is little difficulty in securing supplies in the present state of the market.

It is reported from New York that the United States copper producers have decided to abandon their efforts to formulate a code for the regulation of output and prices, and that they are to confine themselves entirely to labour questions. If this is the case, the administration may produce a compulsory "code" for the industry.

The week's prices have been as follow:—

Cash.—Thursday, £33 16s. 3d. to £33 17s. 6d.; Friday, £33 12s. 6d. to £33 13s. 9d.; Monday, £33 5s. to £33 6s. 3d.; Tuesday, £33 to £33 2s. 6d.; Wednesday, £32 17s. 6d. to £32 18s. 9d.

Three Months.—Thursday, £33 17s. 6d. to £33 18s. 9d.; Friday, £33 13s. 9d. to £33 15s.; Monday, £33 7s. 6d. to £33 8s. 9d.; Tuesday, £33 3s. 9d. to £33 5s.; Wednesday, £33 to £33 1s. 3d.

Tin.—In this market also, quotations have been affected by monetary influences, a slightly firmer sterling resulting in weaker tin prices. Buyers still have to pay a premium for spot metal over forward, owing to the pressure for the former, although the premium is not as large as it was a week or so ago.

Messrs. Rudolf Wolff & Company report that "demand on the part of consumers in this country and on the Continent is only moderate, and in the United States of America quiet conditions have prevailed. The position seems to have undergone no material change: the market still maintains a firm undertone, based on the soundness of the statistical position and the prospect of some seasonal improvement in consumption in the next few months."

Daily quotations:—

Cash.—Thursday, £226 to £226 2s. 6d.; Friday, £226 7s. 6d. to £226 10s.; Monday, £226 7s. 6d. to £226 10s.; Tuesday, £225 15s. to £226; Wednesday, £225 15s. to £225 17s. 6d.

Three Months.—Thursday, £225 12s. 6d. to £225 15s.; Friday, £225 17s. 6d. to £226; Monday, £225 17s. 6d. to £226; Tuesday, £225 12s. 6d. to £225 17s. 6d.; Wednesday, £225 10s. to £225 12s. 6d.

Spelter.—Activity in the spelter-consuming industries in this country is irregularly distributed. The galvanising trade continues to be in a most unsatisfactory position, but, on the other hand, good activity is maintained at many of the brassworks, although, of course, a large amount of scrap is used in the latter connection. There is reported to be a good demand for high-grade spelter.

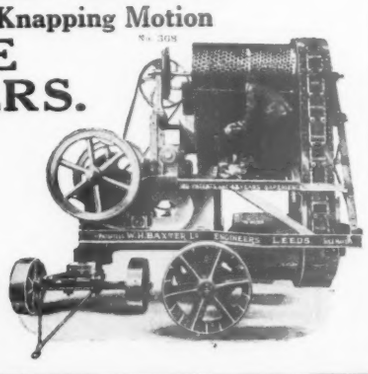
Price fluctuations:—

Ordinary.—Thursday, £15 1s. 3d.; Friday, £15 1s. 3d.; Monday, £15; Tuesday, £14 16s. 3d.; Wednesday, £14 16s. 3d.

Lead.—The lead market has been fairly steady, although subject to the influence of uncertain exchanges. There is a fairly good demand for lead in this country, and there has also been a somewhat better call from the Continent. The news that an important English refinery is to be temporarily closed had a slightly strengthening effect upon the market.

Daily market prices:—

Soft Foreign (Prompt).—Thursday, £11 15s.; Friday, £11 15s.; Monday, £11 10s.; Tuesday, £11 8s. 9d.; Wednesday, £11 11s. 3d.

BAXTER'S
Patent Knapping Motion
STONE BREAKERS.
UNEQUALLED
Sole Makers:—
W.H.BAXTER, LTD.
LEEDS.


FERRO ALLOYS
ALL GRADES, IN POWDER, OR LUMPS FROM STOCK.
FOUNDRY SUPPLIES
FOR IRON OR STEEL.
REFRACTORIES, LADLES, ELECTRODES, ORES AND MINERALS.
WATSONS (Metallurgists) LTD.
Head Office:
ADELAIDE WORKS, MOWBRAY STREET, SHEFFIELD, 3.
Works: PLATT STREET, NEEPSEND, SHEFFIELD.

When ordering or specifying COLD BLAST PIG IRON see that you obtain the *GENUINE* DIRECT BLAST FURNACE PRODUCT—— *not* a cupola or other refined iron or remelt.

GENUINE **COLD BLAST PIG IRON IS SMELTED VERY SLOWLY IN A *BLAST FURNACE* WITH BLAST AT ATMOSPHERIC TEMPERATURE.**

THE EARL OF DUDLEY'S ROUND OAK WORKS, LTD.,
BRIERLEY HILL, STAFFS.
Brand : "DUD·L.N.F'ces·DUD"

M. & W. GRAZEBROOK,
LIMITED,
DUDLEY, WORCS.
Brand : "GRAZEBROOK"

THE LOW MOOR IRON
CO., LTD.,
NEW WORKS, LOW MOOR,
BRADFORD - YORKSHIRE.
Brand : "LOWMOOR C.B."

MAKERS OF GENUINE COLD BLAST PIG IRON

RAW MATERIALS—PRICE LIST

(Wednesday, February 14, 1934)

COPPER

	£ s. d.
Standard cash	32 17 6
Three months	33 0 0
Electrolytic	35 17 6
Tough	35 0 0
Best selected	35 10 0
Sheets	64 0 0
India	44 7 6
Wire bars	36 7 6
Ingot bars	36 7 6
H.C. wire rods	38 17 6
Off. av. cash, January	32 12 0 9/11
Do., 3 mths., January	32 14 8 4/11
Do., Sttlmnt., January	32 12 11 6/11
Do., Electro, January	35 18 6 3/11
Do., B.S., January	35 9 8 5/11
Do., wire bars, January	36 4 9 3/11
Solid drawn tubes	10d.
Brazed tubes	10d.
Wire	6½d.

BRASS

Solid drawn tubes	9d.
Brazed tubes	11d.
Rods, drawn	8½d.
Rods, extd. or rlld.	4½d.
Sheets to 10 w.g.	7½d.
Wire	7½d.
Rolled metal	7d.
Yellow metal rods	4½d.
Do. 4 × 4 Squares	5½d.
Do. 4 × 3 Sheets	5½d.

TIN

	£ s. d.
Standard cash	225 15 0
Three months	225 10 0
English	226 10 0
Bars	228 0 0
Straits	230 5 0
Australian (nom.)	—
Eastern	229 0 0
Banca	230 0 0
Off. av. cash, January	226 14 3 9/11
Do., 3 mths., January	226 15 8 3/11
Do., Sttlmt., January	226 14 1 1/11

SPELTER

	£ s. d.
Ordinary	14 16 3
Remelted	15 0 0
Hard	12 0 0
Electro 99.9	17 2 6
English	15 10 0
India	14 5 0
Zinc dust	20 0 0
Zinc ashes	3 5 0
Off. aver., January	14 16 3 15/22
Aver. spot, January	14 13 9

LEAD

	£ s. d.
Soft foreign ppt.	11 11 3
Empire	11 13 9
English	13 0 0
Off. average, January	11 8 2 3/4
Average spot, January	11 6 0 11/22

ALUMINIUM

Ingots	£100 to £105
Wire	1/1 to 1/9 lb.
Sheet and foil	1/2 to 2/9 lb.

ZINC SHEETS, &c.

	£ s. d.
Zinc sheets, English	24 10 0
Do., V.M. ex whse.	23 5 0
Rods	29 0 0

ANTIMONY

	£ s. d.
English	37 10 0 to 40 0 0
Chinese, ex-whse.	26 10 0
Crude	20 0 0

QUICKSILVER

	£ s. d.
Quicksilver	10 10 0 to 10 17 6

FERRO-ALLOYS AND STEEL-MAKING METALS

Ferro-silicon—	
25%	6 10 0
45/50%	13 0 0
75%	18 2 6
Ferro-vanadium—	
35 50%	12/8 lb. Va.
Ferro-molybdenum—	
70/75% carbon-free of Mo.	5/6 per lb.
Ferro-titanium—	
23/25% carbon-free	9d. lb.
Ferro-phosphorus, 20/25%	£14 10 0
Ferro-tungsten—	
80/85%	2/6 lb.
Tungsten metal powder—	
98/99%	2/9 lb.
Ferro-chrome—	
2/4% car.	32 0 0
4/6% car.	23 0 0
6/8% car.	21 12 6
8/10% car.	21 12 6
Ferro-chrome—	
Max. 2% car.	37 10 0
Max. 1% car.	38 15 0
Max. 0.70% car.	42 0 0
70%, carbon-free	10½d. lb.
Nickel—99.5/100%	£225 to £230
"F" nickel shot	£202 10 0
Ferro-cobalt, 98/99%	5/6 lb.
Metallic chromium—	
96/98%	2/5 lb.
Ferro-manganese (net)—	
76/80% loose	£10 15 0 to £11 5 0
76/80% packed	£11 15 0 to £12 5 0
76/80% export	(nom.) £9 15 0
Metallic manganese—	
94/96% carbon-free	1/2 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—	
Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 5/16 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅛ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP

	£ s. d.	£ s. d.
South Wales—		
Heavy steel	2 15 0	to 2 17 6
Bundled steel and shrngs.	2 7 6	to 2 15 0
Mixed iron and steel	2 10 0	to 2 12 6
Heavy cast iron		2 10 0
Good machinery		2 10 0
Cleveland—		
Heavy steel	2 12 6	to 2 14 0
Steel turnings		1 17 6
Cast-iron borings		1 8 9
Heavy forge		2 10 0
W.I. piling scrap		2 5 0
Cast-iron scrap	2 13 6	to 2 15 0
Midlands—		
Light cast-iron scrap		2 7 6
Heavy wrought iron		2 15 0
Steel turnings, f.o.r.	1 13 6	to 1 15 0
Scotland—		
Heavy steel		2 15 0
Ordinary cast iron	2 14 0	to 2 15 0
Engineers' turnings		2 2 6
Cast-iron borings		2 0 0
Wrought-iron piling		2 12 6
Heavy machinery	2 17 6	to 2 18 6

London—Merchants' buying prices, delivered yard.

	£ s. d.
Copper (clean)	28 0 0
Brass	20 0 0
Lead (less usual draft)	11 0 0
Tea lead	8 5 0
Zinc	10 0 0
New aluminium cuttings	68 0 0
Braziery copper	26 0 0
Gunmetal	26 0 0
Hollow pewter	150 0 0
Shaped black pewter	106 0 0

PIG-IRON

(f.o.t. unless otherwise stated)

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	70/-
Foundry No. 3	67/6
„ at Falkirk	67/3
„ at Glasgow	70/3
Foundry No. 4	66/6
Forge No. 4	66/-
Hematite No. 1, f.o.t.	68/-
Hematite M/Nos., f.o.t.	67/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	70/-
„ d/d Birm.	84/6
Malleable iron d/d Birm.	115/-
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	67/-
„ No. 3 fdry.	71/-
Northants forge	63/6
„ fdry. No. 3	67/6
„ fdry. No. 1	70/6
Derbyshire forge	67/-
„ fdry. No. 3	71/-
„ fdry. No. 1	74/-
Scotland—	
Foundry No. 1	72/6
„ No. 3	70/-
Hem. M/Nos. d/d	71/-
Sheffield (d/d district)—	
Derby forge	64/6
„ fdry. No. 3	68/6
Lincs forge	64/6
„ fdry. No. 3	68/6
E.C. hematite	81/6
W.C. hematite	83/6
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	72/-
Staffs fdry. No. 3	72/-
Northants fdry. No. 3	70/6
Cleveland fdry. No. 3	72/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	85/-
Clyde, No. 3	85/-
Monkland, No. 3	85/-
Summerlee, No. 3	85/-
Eglinton, No. 3	85/-
Gartsherrie, No. 3	85/-
Shotts, No. 3	85/-

FINISHED IRON AND STEEL

Usual district deliveries for iron; delivered consumer's station for steel.

Iron—	£ s. d.	£ s. d.
Bars (cr.)	9 0 0	to 9 15 0
Nut and bolt iron	7 0 0	to 7 15 0
Hoops	10 10 0	to 12 0 0
Marked bars (Staffs) f.o.t.	12 0 0	
Gas strip	10 10 0	to 12 0 0
Bolts and nuts, ¾ in. × 4 in.	13 15 0	
Steel—		
Plates, ship, etc.	8 15 0	to 8 17 6
Boiler plts.	8 5 0	to 8 15 0
Chequer plts.		10 7 6
Angles		8 7 6
Tees		9 7 6
Joists		8 15 0
Rounds and squares, 3 in. to 5½ in.		9 7 6
Rounds under 3 in. to ⅝ in. (Untested)		8 12 0
Flats—8 in. wide and over		8 12 6
„ under 8 in. and over 5 in.		8 17 6
Rails, heavy	8 5 0	to 8 10 0
Fishplates	12 0 0	to 12 10 0
Hoops (Staffs)	10 10 0	& up.
Black sheets, 24g. (4-t. lots)	10 5 0	
Galv. cor. shts. („)	12 15 0	
Galv. flat shts. („)	13 5 0	
Galv. fencing wire, 8g. plain	14 0 0	
Billets, soft	5 10 0	
Billets, hard	6 17 6	to 7 2 6
Sheet bars	5 0 0	to 5 10 0
Tin bars	5 0 0	

PHOSPHOR BRONZE

	Per lb. basis.
Strip	11d.
Sheet to 10 w.g.	12d.
Wire	11½d.
Rods	11d.
Tubes	15d.
Castings	13d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	19.26
No. 2 foundry, Valley	17.50
No. 2 foundry, Birm.	18.50
Basic, Valley	17.00
Bessemer	19.76
Malleable, Valley	17.50
Grey forge, Valley	17.50
Ferro-mang. 80%, seaboard	85.00
O.-h. rails, h'y, at mill	36.37½
Billets	26.00
Sheet bars	26.00
Wire rods	36.00
	Cents.
Iron bars, Phila.	1.89
Steel bars	1.75
Tank plates	1.70
Beams, etc.	1.70
Skelp, grooved steel	1.60
Steel hoops	1.85
Sheets, black, No. 24	2.25
Sheets, galv., No. 24	2.85
Wire nails	2.35
Plain wire	2.20
Barbed wire, galv.	2.85
Tinplates, 100-lb. box	$5.25

COKE (at ovens)

Welsh foundry	27/6
„ furnace	17/6 to 18/-
Durham foundry	21/- to 25/-
„ furnace	18/-
Midlands, foundry	—
„ furnace	—

TINPLATES

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 per box	16/3 to 16/6
„	28×20 „	32/6 to 33/-
„	20×10 „	23/3 to 23/9
„	18¾×14 „	16/10½ to 17/-
C.W.	20×14 „	14/10½ to 15/-
„	28×20 „	31/-
„	20×10 „	21/6 to 21/9
„	18⅞×14 „	15/- to 15/3

SWEDISH CHARCOAL IRON & STEEL

Pig-iron	£6 0 0	to £7 0 0
Bars-hammered, basis	£16 0 0	to £16 10 0
Bars and nail-rods, rolled, basis	£15 15 0	to £16 0 0
Blooms	£10 0 0	to £12 0 0
Keg steel	£30 0 0	to £31 0 0
Faggot steel	£18 0 0	to £23 0 0
Bars and rods dead soft, st'l	£10 0 0	to £12 0 0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS

Standard Copper (cash)

		£	s.	d.	
Feb.	8 ..	33	16	3	inc. 3/9
,,	9 ..	33	12	6	dec. 3/9
,,	12 ..	33	5	0	,, 7/6
,,	13 ..	33	0	0	,, 5/–
,,	14 ..	32	17	6	,, 2/6

Electrolytic Copper

		£	s.	d.	
Feb.	8 ..	36	15	0	inc. 5/–
,,	9 ..	36	5	0	dec. 10/–
,,	12 ..	36	5	0	No change
,,	13 ..	35	17	6	dec. 7/6
,,	14 ..	35	17	6	No change

Standard Tin (cash)

		£	s.	d.	
Feb.	8 ..	226	0	0	dec. 15/–
,,	9 ..	226	7	6	inc. 7/6
,,	12 ..	226	7	6	No change
,,	13 ..	225	15	0	dec. 12/6
,,	14 ..	225	15	0	No change

Tin (English ingots)

		£	s.	d.	
Feb.	8 ..	226	10	0	dec. 20/–
,,	9 ..	227	0	0	inc. 10/–
,,	12 ..	227	0	0	No change
,,	13 ..	226	10	0	dec. 10/–
,,	14 ..	226	10	0	No change

Spelter (ordinary)

		£	s.	d.	
Feb.	8 ..	15	1	3	inc. 3/9
,,	9 ..	15	1	3	No change
,,	12 ..	15	0	0	dec. 1/3
,,	13 ..	14	16	3	,, 3/9
,,	14 ..	14	16	3	No change

Spelter (Electro, 99.9 per cent.)

		£	s.	d.	
Feb.	8 ..	17	10	0	No change
,,	9 ..	17	10	0	,, ,,
,,	12 ..	17	5	0	dec. 5/–
,,	13 ..	17	2	6	,, 2/6
,,	14 ..	17	2	6	No change

Zinc Sheets (English)

		£	s.	d.	
Feb.	8 ..	24	10	0	No change
,,	9 ..	24	10	0	,, ,,
,,	12 ..	24	10	0	,, ,,
,,	13 ..	24	10	0	,, ,,
,,	14 ..	24	10	0	,, ,,

Lead (English)

		£	s.	d.	
Feb.	8 ..	13	0	0	No change
,,	9 ..	13	0	0	,, ,,
,,	12 ..	13	0	0	,, ,,
,,	13 ..	13	0	0	,, ,,
,,	14 ..	13	0	0	,, ,,

AVERAGE MONTHLY PRICES OF STEEL SHIP PLATES (NORTH OF ENGLAND)

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1898	5 10 0	5 8 9	5 8 9	5 10 0	5 16 3	5 18 9	5 17 6	6 0 0	6 2 6	6 5 0	6 10 0	6 15 0	5 18 6½
1899	6 15 0	7 0 0	7 2 6	7 2 6	7 2 6	7 2 6	7 2 6	7 12 6	7 12 6	7 12 6	8 0 0	7 6 8	7 6 5½
1900	8 0 0	8 0 0	8 2 6	8 5 0	8 7 6	8 7 6	8 7 6	8 0 0	8 0 0	8 0 0	7 10 0	7 0 0	8 0 0
1901	6 15 0	6 15 0	6 5 0	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	6 7 6	6 5 0	6 0 0	6 0 0	6 4 4
1902	5 17 6	5 12 6	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 10 0	5 14 7½
1903	5 10 0	5 10 0	5 15 0	6 0 0	6 0 0	6 0 0	5 12 0	5 12 6	5 12 6	5 12 6	5 12 6	5 10 0	5 13 11
1904	5 7 6	5 10 0	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 11 10
1905	5 15 0	5 17 6	5 17 6	5 17 6	5 17 6	5 17 6	5 17 6	5 17 6	6 0 0	6 10 0	7 0 0	7 0 0	6 2 3½
1906	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 0 0	7 10 0	7 0 10½
1907	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 10 0	7 0 0	7 0 0	7 8 4
1908	6 10 0	6 10 0	6 10 0	6 5 0	6 5 0	6 5 0	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	6 3 9
1909	6 0 0	6 0 0	6 0 0	6 0 0	6 0 0	5 15 0	5 15 0	5 15 0	6 0 0	6 0 0	6 0 0	6 0 0	5 18 9
1910	6 5 0	6 5 0	6 7 6	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 15 0	6 15 0	6 15 0	6 10 2
1911	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 15 0	6 18 4	6 15 3½
1912	7 3 9	7 5 0	7 5 0	7 12 6	7 15 0	7 15 0	7 15 0	8 0 0	8 0 0	8 0 0	8 2 0	8 5 0	7 14 10
1913	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	8 5 0	7 19 0	7 15 0	7 3 0	6 15 0	6 10 0	7 16 5½
1914	6 10 0	6 10 0	6 10 0	6 10 0	6 10 0	6 0 0	6 0 0	7 0 0	7 5 0	7 5 0	7 6 3	7 10 0	6 14 8½
1915	8 0 0	8 10 0	9 0 0	9 10 0	9 10 0	10 0 0	10 0 0	10 0 0	10 0 0	10 0 0	10 5 0	11 0 0	9 12 11
1916	11 7 6	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 9 2
1917	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0
1918	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0	11 10 0
1919	11 10 0	14 0 0	14 0 0	14 0 0	17 0 0	17 7 6	17 15 0	18 5 0	18 5 0	18 5 0	19 12 6	21 5 0	16 15 5
1920	22 10 0	23 10 0	23 10 0	23 10 0	23 10 0	23 10 0	23 10 0	23 10 0	24 0 0	24 10 0	24 5 0	24 5 0	23 13 4
1921	23 5 0	22 10 0	20 4 0	19 0 0	19 0 0	17 0 0	15 0 0	14 15 0	13 12 0	12 5 0	10 10 0	10 10 0	16 9 3
1922	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 4 0	10 0 0	9 7 6	9 4 0	9 5 0	9 5 0	9 5 0	9 18 4½
1923	9 7 6	9 15 0	10 5 0	10 10 0	10 10 0	10 10 0	9 18 9	9 17 6	9 17 6	9 17 6	9 18 6	10 6 10½	10 1 2½
1924	10 1 6	9 18 1½	9 17 6	9 17 6	9 17 6	9 19 4½	10 5 0	10 5 0	10 5 0	9 19 0	9 15 0	9 15 0	9 19 7½
1925	9 14 0	9 10 0	9 10 0	9 1 3	9 0 0	9 0 0	8 17 0	8 13 1½	8 7 6	8 5 6	7 16 3	7 14 3	8 15 8½
1926	7 12 2½	7 12 6	7 12 6	7 14 4½	7 15 0	7 16 10½	8 2 6	8 2 6	8 4 0	8 12 6	8 12 6	8 16 3	8 1 1½
1927	8 17 6	8 17 6	8 11 6	8 7 6	8 6 3	8 5 0	8 5 0	8 3 9	8 2 6	8 2 6	8 5 0	8 5 0	8 7 5
1928	8 2 6	8 5 0	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 6 10½
1929	8 7 6	8 7 6	8 7 6	8 7 6	8 10 6	8 12 6	8 12 6	8 12 6	8 12 6	8 12 6	8 12 6	8 13 9	8 10 9½
1930	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0
1931	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0
1932	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0
1933	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0	8 15 0
1934	8 15 0	—	—	—	—	—	—	—	—	—	—	—	—

WILLIAM JACKS & COMPANY,

WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

CLARENCE CHAMBERS, 39, CORPORATION STREET, BIRMINGHAM.

13, RUMFORD STREET, LIVERPOOL.

PIG IRON

REGISTERED TRADE MARK

LIMPET

All grades FOUNDRY, HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM JACKS & COMPANY,

CENTRAL CHAMBERS, 93, HOPE ST., GLASGOW, C.2.

ZETLAND ROAD, MIDDLESBROUGH.

Notice.

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 6 words per line. Minimum charge for one insertion 3/-

(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED

ADVERTISER, well established among ironfounders with travelling Midland Counties and Lancashire, is desirous of selling pig-iron for a blast-furnace company.—Address, Box 654, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

ASSISTANT Foundry Manager, fully-qualified Metallurgist (35 years), desires change. Thoroughly experienced in steel (stainless, manganese and mild), cast-iron, brass and bronze castings (marine engines, heavy crusher and grinding plant and motor-car). Able to take full control. Accustomed to open-hearth, electric arc, air and cupola furnace operations, heat-treatment, etc. Excellent testimonials from three previous employers. Investment considered.—Apply, Box 658, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

A SPLENDID opportunity occurs, in well-known, old-established malleable-iron business, for Working Foundry Foreman, able to take full control. Must have had actual experience in patternmaking, cupola work, stump and machine moulding (small articles), also annealing by gas oven.—Write, stating age, wage, and full particulars of experience, to Box 656, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

FULLY-QUALIFIED Foundry Plant Superintendent desires change. Latest methods of mass production, light castings.—Box 664, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

LARGE NORTH LONDON WORKS require Foundry Foreman for non-ferrous metals. Only first-class men, with thorough experience in brasses, bronzes, etc., and electric induction furnaces, need apply.—Write, stating age, salary required, and full details of previous experience, to Box 666, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

PIG-IRON Salesman.—Large Midland firm of pig-iron producers require a Salesman for their foundry and forge irons in London and district.—Replies, with full particulars, to Box 642, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

PUBLICATION

RYLAND'S DIRECTORY of the Coal, Iron, Steel, Tinplate, Metal, Engineering, Hardware and Allied Trades. 1934 edition now ready. Price 42s. cloth bound, 52s. morocco. Order *YOUR* copy *NOW*.—INDUSTRIAL NEWSPAPERS, LIMITED, 49, Wellington Street, Strand, London, W.C.2.

FINANCIAL

CAPITAL offered for established business definitely showing net profit. Active Partnership or Directorship required.—Write, WALSH, 65, New Bond Street, London, W.1.

BUSINESS FOR SALE

FOR Sale.—Private Limited Company incorporated in Portugal, owning ironfoundry and general engineering workshops at Oporto suitable for adaptation to varied engineering purposes.—Box 652, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

MACHINERY

BRINELL Testing Machine required, second-hand; must be in good condition. Hydraulic type preferred, 3,000-kg. load.—S. RUSSELL & SONS, LIMITED, Bath Lane, Leicester.

MODERN WEIGHING MACHINES:—
5-cwt. Portable Avery Platform, type 282; £12.
7-cwt. Portable Avery Platform: £14.
1-ton Denison Crane Weigher: £9.
2-ton Denison Crane Weigher: £12.
5-ton Denison Crane Weigher: £17.
15-ton Denison Crane Weigher: £28.
All Overhauled, Re-stamped and Warranted.
A. HAMMOND, 14, Australia Road, Slough.
'Phone: 287 Slough.

SANDBLAST PLANTS

Room, Rotary Barrel and Cabinet Types complete; 12 in stock.

SAND PLANT

Sand Mills, 6-ft., 5-ft. and 4-ft. 6-in. dia. Pans.
Rotoil "Senior" Oil Core Sand Mixer.
Pneulec Sand Drying Plant, output 1 ton per hour.
Brearley Type Disintegrators.

MOULDING MACHINES

Hand and Pneumatic Types.
Also
Six Rowlands Double-ended Grinders for 24-in. dia. x 2-in. wheels.
Electrical and Belt-driven Blowers and Exhaust Fans, Ladles, etc., etc.

AIR COMPRESSORS

All sizes for high and low pressures.

S. C. BILSBY, A.M.I.C.E., A.M.I.E.E.
CROSSWELLS ROAD (Adjoining Railway Crossing), LANGLEY, Nr. Birmingham.
'Phone: Broadwell 1359.

THOS. W. WARD, LTD.

New PNEU. SAND MOULDER, admit 16" x 16" x 6" boxes, 100 lbs. press.
Unused "Rateau" BLOWER, 18"-sq. outlet, 2½ lbs. press., for 12,000 cub. ft. air per min.
CAPSTAN LATHES, 6" to 8" centres, 3-speed cones.
2 very good CORNISH BOILERS, 20' long x 6' dia., 175 lbs. w.p.
Several very good Secondhand Single-web CRANE-TRACK PLATE GIRDERS, in 40' lengths, 30" deep, with bridge rail on top.
Write for "Albion" Catalogue.
'Grams: "Forward." 'Phone: 23001 (10 lines).
ALBION WORKS, SHEFFIELD

MACHINERY—*Continued*

SURPLUS Foundry Plant, in excellent condition, for disposal.—Address inquiries to Box 662, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

MOULDING MACHINES of all types and sizes in Stock.
SAND MIXERS.
CONVEYORS.
CORE OVENS.
FOUNDRY EQUIPMENT.
Send for Quotations.—Box 584, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

MISCELLANEOUS

PATENT "Non-Leak" Chaplet. All manufacturing and selling rights for sale. Quite new and definitely superior. Any information or interviews.—Apply, Box 660, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

PATTERNS.—Inquiries solicited; quotations by return; shop equipped with modern machinery; quick delivery.—CLEGHORN & COMPANY, Midland Pattern Works, Spring Gardens, Worcester. 'Phone 264

PARTING POWDER (genuine and original kind).—Advertisers, having purchased a large quantity, offer to the foundry in minimum lots of 5 cwts. packed in bags at 11s. 6d. per cwt.—Write to Box 612, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

LINSEED OIL for foundry purposes; spot lot of 40 tons available for immediate delivery in lots of 1 ton and upwards, price £20 per ton, barrels free, delivered works.—Address, Box 610, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

PATTERNS.—Inferior Patterns make trouble in the foundry. Why not buy the best—they cost very little more.—Send to FURMSTON & LAWLOR, Letchworth, Herts.

'Phone: 287 SLOUGH

SANDBLAST PLANTS

12' × 9' Tilghman sandblast room, built of cast iron plates, complete with 400 cu. ft. Tilghman air compressor and all accessories **£290 Nett.**

6' × 6' × 8' Tilghman Sandblast room, similar to above, but with B.H.2 Tilghman horizontal compressor: price complete **£130**. Several small Tilghman plants.

6' "Jackman" rotary sandblast table. CHEAP seen working.

SAND PLANT

Herbert "Whizzer" type disintegrator, No. 1	£30
Rotary Sand Dryer by Titan	£55
Gyratory sand riddle with motor	£7

Large "Baillott" sand preparing plant CHEAP.

BUY FROM ME AND SAVE MONEY!

ALEX. HAMMOND, *Foundry Machinery Merchant,*
14, AUSTRALIA ROAD, SLOUGH

SUPERIOR SILICA BRICKS
FINE SILICA CEMENT.
TRADE MARK—R. DINAS.
SMARTS DINAS SILICA BRICK CO. LTD., KIDWELLY

RYLAND'S DIRECTORY
[2,200 pages 8½" × 5½"].
The standard work of reference covering the Coal, Iron, Steel, Tinplate, Metal, Foundry, Engineering, Hardware and Allied Trades.
1934 edition now ready. Price **42/-** bound in Cloth.
INDUSTRIAL NEWSPAPERS Ltd., 49, Wellington Street, Strand, London, W.C.2.
Telephone: Temple Bar 3951 (5 lines).